

Application No.: 09/814,828

2

Docket No.: 8733.246.00-US


While the information and references disclosed in this Information Disclosure Statement may be "material" pursuant to 37 CFR 1.56, it is not intended to constitute an admission that any patent, publication or other information referred to therein is "prior art" for this invention unless specifically designated as such.

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

The Commissioner is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 50-0911, under Order No. 8733.246.00-US. A duplicate copy of this paper is enclosed.

Dated: February 26, 2002

Respectfully submitted,

By 
Song K. Jung
Registration No.: 35,210

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Attorneys for Applicants



PTO/SB/06A (10-01)
Approved for use through 10/31/2002 OMB 0551-0031
U. S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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|---|---|--------------------------|------------------|
| Substitute for form 1449A/PTO | | Complete if Known | |
| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | Application Number | 09/814,828 |
| | | Filing Date | March 23, 2001 |
| | | First Named Inventor | Sal C. Yun |
| | | Art Unit | N/A |
| | | Examiner Name | Not Yet Assigned |
| | | Attorney Docket Number | 8733.246.00-US |
| Sheet | 1 | of | 1 |

| U.S. PATENT DOCUMENTS | | | | | |
|-----------------------|-----------|---|--------------------------------|--|--|
| Examiner Initials* | Cite No.† | Document Number Number/Kind Code* (if known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
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| FOREIGN PATENT DOCUMENTS | | | | | |
|--------------------------|-----------|--|--------------------------------|--|--|
| Examiner Initials* | Cite No.† | Foreign Patent Document Country Code*+Number*+Kind Code* (if known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
| AK | A | JP-11271795- | 10-08-1999 | Kimiaki et al. | |
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| OTHER PRIOR ART – NON PATENT LITERATURE DOCUMENTS | | | |
|---|-----------|---|----------------|
| Examiner Initials* | Cite No.† | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T ² |
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|--------------------|--|-----------------|----------|
| Examiner Signature | | Date Considered | 03/18/03 |
|--------------------|--|-----------------|----------|

* Applicant's unique citation designation number (optional). † See attached Kind Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ‡ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). * For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the application number of the patent document. * Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST 16 if possible. * Applicant is to place a check mark here if English language Translation is attached.

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/814,828 | 03/23/2001 | Sai Chang Yun | 8733 246.00 | 4728 |

JOR27 7590 03/24/2003

MCKENNA LONG & ALDRIDGE LLP
 1900 K STREET, NW
 WASHINGTON, DC 20006

EXAMINER

ROMAN, ANGEL

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 03/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | | |
|------------------------------|-----------------|--|--------------|--|
| Office Action Summary | Application No. | | Applicant(s) | |
| | 09/814,828 | | YUN ET AL. | |
| | Examiner | | Art Unit | |
| | Angel Roman | | 2812 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on _____

2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-15 is/are pending in the application

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed

6) ☒ Claim(s) 1,4-7,9-12,14 and 15 is/are rejected

7) ☒ Claim(s) 2,3,8 and 13 is/are objected to

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on 23 March 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner

If approved, corrected drawings are required in reply to this Office action

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some * c) ☐ None of:

1 ☒ Certified copies of the priority documents have been received

2 ☐ Certified copies of the priority documents have been received in Application No. _____

3 ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a))

* See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application)

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

| | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s) _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3</u> | 6) <input type="checkbox"/> Other: |

Application/Control Number: 09/814,828
Art Unit: 2812

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DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: Number 4, in figure 1A. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance

Specification

2. The disclosure is objected to because of the following informalities: In page 4, line 4, number "3" should be replaced with --2--

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States

4. Claims 1, 4-7, 9-12, 14 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Tajima et al. U.S. Patent 5,398,128 A.

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Art Unit: 2812

Page 3

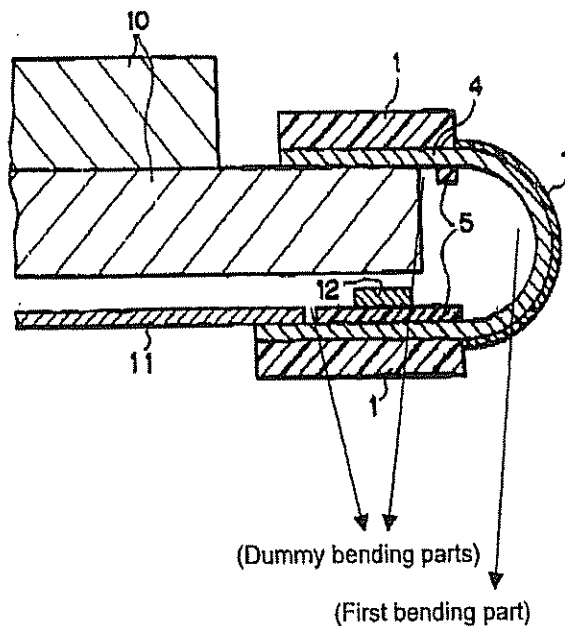
Tajima et al. discloses a liquid crystal display device, comprising; a liquid crystal panel 10; a printed circuit board 11; and a tape carrier package connected to the liquid crystal panel and the printed circuit board, the tape carrier package comprising, a base film 5 mounted with an integrated circuit chip 12 for applying a signal to the liquid crystal panel 10, an output pad part 4 extending from the integrated circuit chip 12 and having terminals connected to the liquid crystal panel, a dummy bending part in which a portion of the base film 5 is removed in a direction perpendicular to the terminals of the output pad part for reducing a thermal expansion force and a thermal contraction force generated when thermal pressing the output pad part onto the liquid crystal panel; a first bending part in which a second portion of the base film existing at a bent position between the dummy bending part and the integrated circuit chip is removed, and an input pad part extending from the integrated circuit chip and having terminals connected to the printed circuit board (see figure 6 below). The tape carrier package further comprises a second dummy bending part in which a third portion of the base film is removed in a direction perpendicular to the terminals of the output pad part.

As to the language in claim 1, lines 11-13, "for reducing a thermal expansion force and a thermal contraction force generated when thermal pressing the output pad part onto the liquid crystal panel", applicant should note that this is merely "result" language which cannot be relied upon to define over Tajima et al. since Tajima et al. discloses all of the claimed elements and their recited relationships. Moreover, the examiner will presume that the recited results are inherent in Tajima et al. since all of the claimed elements and the relationship therebetween are met by Tajima et al.

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 Art Unit: 2812

Page 4

Figure 6



5. Claims 5 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Tagusa et al. U.S. Patent 5,668,700 A.

Tagusa et al. discloses A tape carrier package, comprising; a pad part for connection to a liquid crystal panel; a base film mounted with an integrated circuit chip 1 for applying a signal to the liquid crystal panel; and a dummy bending part, for distributing a stress applied to the liquid crystal panel according to a thermal expansion of the pad part by removing a portion of the base film between the pad part and the

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Art Unit: 2812

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integrated circuit chip 1. The tape carrier package further comprises a second pad part for connection to a printed circuit board (see figure 6).

Allowable Subject Matter

6. Claims 2, 3, 8 and 13 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: The prior art either singularly or in combination failed to anticipate or render obvious the limitations of disclosing a tape carrier package comprising a second bending part in which a third portion of the base film existing at a bent position between the input pad part and the integrated circuit chip is removed as required by claim 2.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Adachi et al., Yamazaki, Takamatsu et al., Tagawa, Kawaguchi et al. and Tanaka et al. disclose tape carrier packages comprising removed portions.

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Art Unit: 2812


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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angel Roman whose telephone number is (703) 306-0207. The examiner can normally be reached on Monday-Friday 8:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (703) 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

AR
March 20, 2003


John F. Niebling
Supervisory Patent Examiner
Technology Center 2800

| | | | |
|-----------------------------------|--------------------------------------|--|-------------|
| Notice of References Cited | Application/Control No 09/814,828 | Applicant(s)/Patent Under Reexamination YUN ET AL. | |
| | Examiner Angel Roman | Art Unit 2812 | Page 1 of 1 |

U.S. PATENT DOCUMENTS

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
|---|---|--|-----------------|------------------|----------------|
| | A | US-5,398,128 | 03-1995 | Tajima et al. | 349/150 |
| | B | US-5,668,700 | 09-1997 | Tagusa et al. | 361/779 |
| | C | US-6,104,464 | 08-2000 | Adachi et al. | 349/150 |
| | D | US-5,362,547 | 11-1994 | Yamazaki, Hideo | 428/167 |
| | E | US-4,474,432 | 10-1984 | Takamatsu et al. | 349/150 |
| | F | US-4,287,525 | 09-1981 | Tagawa, Takao | 347/148 |
| | G | US-5,528,403 | 06-1996 | Kawaguchi et al. | 349/149 |
| | H | US-5,670,994 | 09-1997 | Kawaguchi et al. | 345/206 |
| | I | US- | | | |
| | J | US- | | | |
| | K | US- | | | |
| | L | US- | | | |
| | M | US- | | | |

FOREIGN PATENT DOCUMENTS

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | Classification |
|---|---|--|-----------------|---------|---------------|----------------|
| | N | JP404304427A | 10-1992 | Japan | Tanaka et al. | |
| | O | | | | | |
| | P | | | | | |
| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

NON-PATENT DOCUMENTS

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707 05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PTO/SB/22 (05-03)

Approved for use through 4/30/2003. OMB 0551-0031

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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket No. (Optional)

8733,246.00-US



In re Application of Sal C Yun. et al.

Application Number
09/814,828.Filed
March 23, 2001For: TAPE CARRIER PACKAGE WITH DUMMY BENDING PART AND
LIQUID CRYSTAL DISPLAY EMPLOYING THE SAME

Art Unit 2812

Examiner A Roman

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and appropriate non-small-entity fee are as follows (check time period desired):

- ☒ One month (37 CFR 1.17(a)(1)) \$ 110.00
- ☐ Two months (37 CFR 1.17(a)(2)) \$
- ☐ Three months (37 CFR 1.17(a)(3)) \$
- ☐ Four months (37 CFR 1.17(a)(4)) \$
- ☐ Five months (37 CFR 1.17(a)(5)) \$

☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee amount shown above is reduced by one-half, and the resulting fee is: \$☒ A check in the amount of the fee is enclosed.☐ Payment by credit card. Form PTO-2038 is attached.☐ The Director has already been authorized to charge fees in this application to a Deposit Account.☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-0911.

I have enclosed a duplicate copy of this sheet.

I am the ☐ applicant/inventor.☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)☐ attorney or agent of record.☒ attorney or agent under 37 CFR 1.34(a).

Registration number if acting under 37 CFR 1.34(a) 41,788

July 22, 2003

Date

(202) 498-7463

Telephone Number

Signature

Rebecca Goldman Rudich

Typed or Printed Name

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of 1 forms are submitted.

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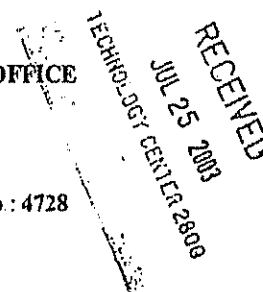
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



Appl. No. : 09/814,828 Confirmation No. : 4728
Applicant : Sai Chan Yun, et al.
Filed : March 23, 2001
TC/A.U. : 2812
Examiner : Angel Roman
For : TAPE CARRIER PACKAGE WITH DUMMY BENDING PART
AND LIQUID CRYSTAL DISPLAY EMPLOYING THE SAME

Docket No. : 8733.246.00
Customer No. : 30827

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office Action of March 24, 2003, please amend the above-identified application as follows:

- Amendments to the Specification begin on page 2 of this paper.
- Amendments to the Claims are reflected in the listing of claims which begins on page 4 of this paper.
- Amendments to the Drawings begin on page 10 of this paper and include a replacement sheet.
- Remarks begin on page 11 of this paper.
- An Appendix including amended drawing figures is attached following page 11 of this paper.

U.S. Application No. 09/814,828
Amendment dated July 22, 2003
Reply to Office Action of March 24, 2003

Docket No.:8733 246.00

Amendments to the Specification

Please replace the paragraph at page 3, line 10 with the following amended paragraph:

"The TAB method may be divided into a bending type as shown in Fig. 1A, and a flat type as shown in Fig. 1B. The bending-type TAB system as shown in Fig. 1A has been used for a mounting of source and gate drivers of a monitor or a notebook computer. In the bending-type TAB system, a PCB 6 is folded to the rear side of a liquid crystal panel 2 by bending a tape carrier package (TCP) 10 mounted with a D-IC 8 and connected between a lower glass substrate 3 of the liquid crystal panel 2 and the PCB 6. A backlight unit 4 is positioned below the liquid crystal display panel 2. As shown in Fig. 2 and Fig. 3, an adhesive 25 is coated on a base film 24 of the TCP 10, and a lead part 26 is adhered thereon. The lead part 26 made from copper (Cu) is connected to pins of the D-IC 8. On the lead 26 is coated a solder resistor 27 responsible for providing an insulator. At the upper end and the lower end of the base film 24, an input pad part 21 and an output pad part 22 extending from each lead of the lead part 26 are provided. The input pad part 21 is connected to an output signal wiring of the PCB while the output pad part 22 is connected to the gate line or the data line formed on a lower glass substrate 3. Bending parts 10a and 10b are provided between the input pad part 21 and the D-IC 8 and between the output pad part 22 and the D-IC 8, respectively. The base film 24 is removed from the bending parts 10a and 10b. The TCP 10 is easily bent with the aid of these bending parts 10a and 10b."

U.S. Application No. 09/814,828
Amendment dated July 22, 2003
Reply to Office Action of March 24, 2003

Docket No.:8733 246.00

Please replace the first paragraph of page 4 with the following amended paragraph:

"The flat-type TAB system as shown in Fig. 1B is mainly used to mount gate drivers of a 10.4" or 12.1" small-size notebook computer or monitor. In the flat-type TAB system, a TCP 12 mounted with a D-IC 8 and connected between a lower glass substrate 3 of a liquid crystal panel [[3]] 2 and a PCB 6 is arranged in parallel to the liquid crystal panel 2. Thus, since the TCP 12 connected between the liquid crystal panel 2 and the PCB 6 is not bent, no bending part is formed."

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 Amendment dated July 22, 2003
 Reply to Office Action of March 24, 2003

Docket No :8733 246.00

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A liquid crystal display device, comprising:
 - a liquid crystal panel;
 - a printed circuit board; and
 - a tape carrier package connected to the liquid crystal panel and the printed circuit board,
 the tape carrier package comprising[[,]]:
 - a base film mounted with an integrated circuit chip for applying a signal to the liquid crystal panel;
 - an output pad part extending from the integrated circuit chip and having terminals connected to the liquid crystal panel[[,]];
 - a dummy bending part in which a portion of the base film is removed in a direction perpendicular to the terminals of the output pad part for reducing a thermal expansion force and a thermal contraction force generated when thermal-pressing the output pad part onto the liquid crystal panel[[,]];
 - a first bending part in which a second portion of the base film existing at a bent position between the dummy bending part and the integrated circuit chip is removed[[,]]; and
 - an input pad part extending from the integrated circuit chip and having terminals connected to the printed circuit board[[.]].

wherein the dummy bending part is formed at a position, close to any one of the output pad part or the input pad part, where the tape carrier package is not folded.

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2. (Currently Amended) A liquid crystal display device, comprising:

a liquid crystal panel;

a printed circuit board; and

a tape carrier package connected to the liquid crystal panel and the printed circuit board,

the tape carrier package comprising:

a base film mounted with an integrated circuit chip for applying a signal to the liquid crystal panel;

an output pad part extending from the integrated circuit chip and having terminals connected to the liquid crystal panel;

a dummy bending part in which a portion of the base film is removed in a direction perpendicular to the terminals of the output pad part for reducing a thermal expansion force and a thermal contraction force generated when thermal-pressing the output pad part onto the liquid crystal panel;

a first bending part in which a second portion of the base film existing at a bent position between the dummy bending part and the integrated circuit chip is removed;

an input pad part extending from the integrated circuit chip and having terminals connected to the printed circuit board; and

The liquid crystal display device of claim 1, wherein the tape carrier package further comprises a second bending part in which a third portion of the base film existing at a bent position between the input pad part and the integrated circuit chip is removed.

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Docket No.: 8733.246.00

3. (Original) The liquid crystal display panel of claim 2, wherein the tape carrier package further comprises a second dummy bending part in which a fourth portion of the base film is removed in a direction perpendicular to the terminals of the output pad part.

4. (Original) The liquid crystal display device of claim 1, wherein the tape carrier package further comprises a second dummy bending part in which a third portion of the base film is removed in a direction perpendicular to the terminals of the output pad part.

5. (Currently Amended) A tape carrier package, comprising:
a pad part for connection to a liquid crystal panel;
a base film mounted with an integrated circuit chip for applying a signal to the liquid crystal panel; and
a dummy bending part for distributing a stress applied to the liquid crystal panel according to a thermal expansion of the pad part by removing a portion of the base film between the pad part and the integrated circuit chip[[.]].
wherein the dummy bending part is formed at a position, close to the pad part, where the tape carrier package is not folded.

6. (Original) The tape carrier package according to claim 5, further comprising a first bending part in which a second portion of the base film is removed at a bent position between the dummy bending part and the integrated circuit chip.

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Amendment dated July 22, 2003
Reply to Office Action of March 24, 2003

Docket No.: 8733 246.00

7. (Original) The tape carrier package according to claim 6, further comprising a second pad part for connection to a printed circuit board.

8. (Currently Amended) A tape carrier package, comprising:

a pad part for connection to a liquid crystal panel;

a base film mounted with an integrated circuit chip for applying a signal to the liquid crystal panel;

a dummy bending part for distributing a stress applied to the liquid crystal panel

according to a thermal expansion of the pad part by removing a portion of the base film between the pad part and the integrated circuit chip;

a first bending part in which a second portion of the base film is removed at a bent position between the dummy bending part and the integrated circuit chip;

a second pad part for connection to a printed circuit board; and

The tape carrier package according to claim 7, further comprising a second bending part in which a third portion of the base film is removed at a bent position between the second pad and the integrated circuit chip.

9. (Original) The tape carrier package according to claim 5, further comprising a second pad part for connection to a printed circuit board.

10. (Original) The tape carrier package according to claim 5, further comprising a second dummy bending part in which a second portion of the base film is removed.

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Amendment dated July 22, 2003
Reply to Office Action of March 24, 2003

Docket No.: 8733 246.00

11. (Original) The tape carrier package according to claim 10, further comprising a first bending part in which a third portion of the base film is removed at a bent position between the dummy bending part and the integrated circuit chip.

12. (Original) The tape carrier package according to claim 11, further comprising a second pad part for connection to a printed circuit board.

13. (Currently Amended) A tape carrier package, comprising:
a pad part for connection to a liquid crystal panel;
a base film mounted with an integrated circuit chip for applying a signal to the liquid crystal panel;
a dummy bending part for distributing a stress applied to the liquid crystal panel according to a thermal expansion of the pad part by removing a portion of the base film between the pad part and the integrated circuit chip;
a second dummy bending part in which a second portion of the base film is removed;
a first bending part in which a third portion of the base film is removed at a bent position between the dummy bending part and the integrated circuit chip;
a second pad part for connection to a printed circuit board; and
~~The tape carrier package according to claim 12, further comprising~~ a second bending part in which a fourth portion of the base film is removed at a bent position between the second pad and the integrated circuit chip.

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Amendment dated July 22, 2003
Reply to Office Action of March 24, 2003

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14. (Original) A tape carrier package, comprising:
a base film mounted with an integrated circuit chip for applying a signal to a liquid crystal panel;
a pad part extending from the integrated circuit chip to be connected to the liquid crystal panel;
at least one bending part in which a portion of the base film is removed at an area where the tape carrier package is folded; and
at least one dummy bending part, in which a second portion of the base film is removed at a portion where the tape carrier package is not folded, thereby reducing a thermal expansion force and a thermal contraction force of the base film parallel to a longitudinal direction of the integrated circuit chip.

15. (Original) The tape carrier package according to claim 14, wherein said dummy bending part is positioned on the pad part.

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Reply to Office Action of March 24, 2003

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Amendments to the Drawings

The attached sheet of drawings includes changes to FIG. 12. This sheet, which includes FIGs. 12-13, replaces the original sheet including FIG. 12-13. In FIG. 12, the line C-C has been removed.

Attachment: Replacement Sheet for FIGs 12-13

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Reply to Office Action of March 24, 2003

Docket No.: 8733 246.00

REMARKS

At the outset, the Examiner is thanked for the thorough review and consideration of the pending application. The office action dated March 24, 2003 has been received and its contents carefully reviewed.

The Examiner objects to the drawings for including a reference sign, "4" in Figure 1A, that is not mentioned in the specification. Applicant has amended the specification to include a description of this reference number. No new matter is added by this amendment. Applicant respectfully requests the Examiner to withdraw the objection. Applicant also amends the specification to correct a minor typographical error, thereby overcoming the Examiner's objection. Applicant respectfully requests the Examiner to withdraw the objections to the drawings and specification.

Applicant also submits a new formal drawing for Figure 12 in an Appendix to this Paper.

Claims 1, 4-7, 9-12, 14 and are rejected under 35 U.S.C. 102(b) as being anticipated by Tajima et al. (U.S. Patent No. 5,398,128). Applicant amends claims 1 and 5 to more clearly recite those features of the invention that were inherent in the original claims.

In the Office Action, claims 1, 4-7, 9-12, 14 and 15 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,398,128 to Tajima et al. (hereinafter "Tajima"). Claims 5 and 9 are rejected under 35 U.S.C. § 102(b) as being unpatentable over U.S. Patent No. 5,668,700 to Tagusa et al. (hereinafter "Tagusa"). Claims 2, 3, 8 and 13 are objected to as being dependent on a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant rewrites claims 2, 3, 8, and 13 in independent form, including all of the limitations of the base claim and any intervening claims, and respectfully submits that these claims as amended are allowable.

The rejection of independent claim 1 is respectfully traversed and reconsideration is requested. Claim 1 is allowable over the cited references in that this claim recites a combination of elements including, for example, "wherein the dummy bending part is formed at a position, close to any one of the output pad part or the input pad part, where the tape carrier package is not folded" (claim 1). None of the cited references including Tajima and Tagusa, singly or in combination, discloses, teaches or suggests at least this feature of the claimed invention.

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The rejection of independent claim 14 is respectfully traversed and reconsideration is requested. Claim 14 is allowable over the cited references in that this claim recites a combination of elements including, for example, "a second portion of the base film is removed at a portion where the tape carrier package is not folded" (claim 14). None of the cited references including Tajima and Tagusa, singly or in combination, discloses, teaches or suggests at least this feature of the claimed invention.

For example, the structure of claims 1 and 14 of the present invention is different from the Tajima structure in that in Tajima, the base film 1 is removed only where the tape carrier package is folded (Tajima, element 2 in Figures 1-5). The gaps identified by the Examiner are not bending parts formed by removing a portion of the base film (identified as element 1 in Tajima). The Examiner incorrectly identifies element 5 as the base film; however, Tajima clearly indicates that element 5 is a solder resist (Tajima, column 3, lines 33-36). Therefore, Tajima does not show the bending parts as required by claims 1 and 14.

The rejection of independent claim 5 is respectfully traversed and reconsideration is requested. Claim 5 is allowable over the cited references in that this claim recites a combination of elements including, for example, "wherein the dummy bending part is formed at a position, close to the pad part, where the tape carrier package is not folded" (claim 5). None of the cited references including Tajima and Tagusa, singly or in combination, discloses, teaches or suggests at least this feature of the claimed invention.

For example, the structure of claim 5 of the present invention is different from the Tagusa structure in that in Tagusa, the substrate 2 is partially removed only where the wiring board 42 is folded (Tagusa, elements 2b and 2c in Figure 6 and column 14, lines 24-55). Furthermore, in Tagusa, no part of the substrate 2 is removed between the pad part and the integrated circuit 1 as required by the claim.

Therefore, independent claims 1, 5, and 14 are allowable at least for these reasons. Applicant submits that claim 4, claims 6, 7, 9-12, and claim 15, which depend from claims 1, 5, and 14, respectively, are allowable over the cited references.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

U.S. Application No. 09/814,828
Amendment dated July 22, 2003
Reply to Office Action of March 24, 2003

Docket No.: 8733 246 00

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at (202) 496-7500 to discuss the steps necessary for placing the application in condition for allowance. All correspondence should continue to be sent to the below-listed address.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37 C.F.R. §1.136 for any necessary extension of time, or any other fees required to complete the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to deposit Account No. 50-0911. A duplicate copy of this sheet is enclosed.

Dated: July 22, 2003

Respectfully submitted,

By



Rebecca Goldman Rudich

Registration No.: 41,786

MCKENNA LONG & ALDRIDGE LLP

1900 K Street, N.W.

Washington, DC 20006

(202) 496-7500



FIG. 12

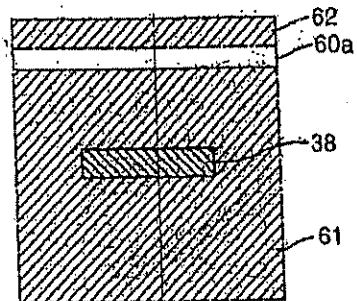
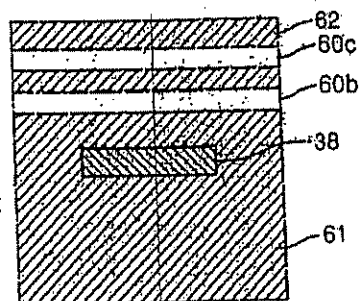


FIG. 13



| | | | |
|-------------------------------|-----------------|--------------|--|
| Notice of Allowability | Applicati n No. | Applicant(s) | |
| | 09/814,828 | YUN ET AL. | |
| | Examiner | Art Unit | |
| | Angel Roman | 2812 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--
 All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS. This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Amend
2. ☒ The allowed claim(s) is/are 1-15
3. ☒ The drawings filed on 22 July 2003 are accepted by the Examiner
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
 * Certified copies not received: _____
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(a) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
 (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 1) ☐ hereto or 2) ☐ to Paper No. _____.
 (b) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the Examiner.
 (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892) | 5 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2 <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. _____ |
| 3 <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. _____ | 7 <input type="checkbox"/> Examiner's Amendment/Comment |
| 4 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8 <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9 <input type="checkbox"/> Other |

Application/Control Number: 09/814,828
Art Unit: 2812

Page 2

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 11 and 12, filed 07/22/2003, with respect to claims 1-15 have been fully considered and are persuasive. The non-final rejection of claims 1, 4-7, 9-12, 14 and 15 has been withdrawn.

Allowable Subject Matter

2. Claims 1-15 are allowed.

3. The following is an examiner's statement of reasons for allowance: As indicated above in paragraph 1, Applicant's arguments filed 07/22/2003 persuaded the Examiner to withdraw the previous non-final rejection of claims 1, 4-7, 9-12, 14 and 15 (see pages 11 and 12 of the remarks section of Applicants amendment filed 07/22/2003).

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angel Roman whose telephone number is (703) 306-0207. The examiner can normally be reached on Monday-Friday 8:30am-6:00pm.



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NOTICE OF ALLOWANCE AND FEE(S) DUE

30427 7590 11/21/2003
MCKENNA LONG & ALDRIDGE LLP
1900 K STREET, NW
WASHINGTON, DC 20006

EXAMINER

ROMAN, ANGEL

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 11/21/2003

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|--------------------|------------------|
| 09/814,828 | 03/23/2001 | Sai Chang Yun | 8733.246.00 | 4728 |

TITLE OF INVENTION: TAPH CARRIER PACKAGE WITH DUMMY BENDING PART AND LIQUID CRYSTAL DISPLAY EMPLOYING THE SAME

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE | PUBLICATION FEE | TOTAL FEE(S) DUE | DATE DUE |
|----------------|--------------|-----------|-----------------|------------------|------------|
| nonprovisional | NO | \$1330 | \$300 | \$1630 | 02/23/2004 |

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHT. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THE STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status is changed, pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above and notify the United States Patent and Trademark Office of the change in status, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check the box below and enclose the PUBLICATION FEE and 1/2 the ISSUE FEE shown above.

☐ Applicant claims SMALL ENTITY status.
See 37 CFR 1.27.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

Page 1 of 4

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
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 or **Fax** (703) 746-4000

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 4 should be completed when appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" maintenance fee notifications.

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Note: A certificate of mailing can only be used for domestic mailings of Fee(s) Transmittal. This certificate cannot be used for any other accompany papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO, on the date indicated below.

(Depositor's name)
 (Signature)
 (Date)

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/814,828 | 03/23/2001 | Sai Chang Yun | 8733 246.00 | 4728 |

TITLE OF INVENTION: TAPE CARRIER PACKAGE WITH DUMMY BENDING PART AND LIQUID CRYSTAL DISPLAY EMPLOYING THE SAME

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE | PUBLICATION FEE | TOTAL FEE(S) DUE | DATE DUE |
|----------------|--------------|----------------|-----------------|------------------|------------|
| nonprovisional | NO | \$1330 | \$300 | \$1630 | 02/23/2004 |
| EXAMINER | ART UNIT | CLASS-SUBCLASS | | | |
| ROMAN, ANGEL | 2812 | 349-149000 | | | |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.563)

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OK, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. _____
 2. _____
 3. _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the USPTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY AND STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ individual ☐ corporation or other private group entity ☐ government

4a. The following fee(s) are enclosed:

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☐ Publication Fee
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

- ☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment Deposit Account Number _____ (enclose an extra copy of this form).

Director for Patents is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.

(Authorized Signature)

(Date)

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS SEND TO: Commissioner for Patents, Alexandria, Virginia 22313-1450.

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 09/814,828 | 03/23/2001 | Sai Chang Yun | 8733 246.00 | 4728 |
| 30827 | 7590 | 11/21/2003 | EXAMINER | |
| MCKENNA LONG & ALDRIDGE LLP 1900 K STREET, NW WASHINGTON, DC 20006 | | | ROMAN, ANGEL | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2812 | |
| DATE MAILED: 11/21/2003 | | | | |

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
 (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 277 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 277 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) system (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office Patent Legal Administration at (703) 305-1383. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.



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|--|-------------|----------------------|---------------------|------------------|
| 09/814,828 | 03/23/2001 | Sai Chang Yun | 8733 246 00 | 4728 |
| 3/19/27 | 7590 | 11/21/2003 | EXAMINER | |
| MCKENNA LONG & ALDRIDGE LLP 1900 K STREET, NW WASHINGTON, DC 20006 | | | ROMAN, ANGEL | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2812 | |
| DATE MAILED: 11/21/2003 | | | | |

Notice of Fee Increase on October 1, 2003

If a reply to a "Notice of Allowance and Fee(s) Due" is filed in the Office on or after October 1, 2003, then the amount due will be higher than that set forth in the "Notice of Allowance and Fee(s) Due" since there will be an increase in fees effective on October 1, 2003. See Revision of Patent Fees for Fiscal Year 2004; Final Rule, 68 Fed. Reg. 41532, 41533, 41534 (July 14, 2003).

The current fee schedule is accessible from (<http://www.uspto.gov/main/howtofees.htm>).

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Effective October 1, 2003, 37 CFR 1.18 is amended by revising paragraphs (a) through (c) to read as set forth below.

Section 1.18 Patent post allowance (including issue) fees.

- (a) Issue fee for issuing each original or reissue patent, except a design or plant patent:
 - By a small entity (Sec. 1.27(a))..... \$665.00
 - By other than a small entity..... \$1,330.00
- (b) Issue fee for issuing a design patent:
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 - By other than a small entity..... \$480.00
- (c) Issue fee for issuing a plant patent:
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30827 7590 11/21/2003

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/814,828 | 03/23/2001 | Sai Chang Yun | 8733.246.00 | 4728 |

TITLE OF INVENTION: TAPE CARRIER PACKAGE WITH DUMMY BENDING PART AND LIQUID CRYSTAL DISPLAY EMPLOYING THE SAME

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE | PUBLICATION FEE | TOTAL FEE(S) DUE | DATE DUE |
|----------------|--------------|----------------|-----------------|------------------|------------|
| nonprovisional | NO | \$1330 | \$300 | \$1630 | 02/23/2004 |
| EXAMINER | ART UNIT | CLASS-SUBCLASS | | | |
| ROMAN, ANGEL | 2812 | 349-149000 | | | |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

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(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Seoul, Korea

Please check the appropriate assignee category or categories (will not be printed on the patent); ☐ individual ☒ corporation or other private group entity ☐ government

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(Authorized Signature) *Rebecca W. Hinton* (Date) *2-20-04*
Rebecca W. Hinton, Reg. No. 41,788

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| QUERY CONTROL FORM | | | RTIS USE ONLY |
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| Application No. <u>09814828</u> | Prepared by <u>T. Smith</u> | Tracking Number _____ | |
| Examiner-GAU <u>Roman-2812</u> | Date _____ | Week Date _____ | |
| No. of queries <u>1</u> | | | |

Attn: Chief Draftsman

| JACKET | | | |
|----------------------|------------------------|--------------------|---|
| a. Serial No. | f. Foreign Priority | k. Print Claim(s) | p. PTO-1449 |
| b. Applicant(s) | g. Disclaimer | l. Print Fig. | q. PTOL-85b |
| c. Continuing Data | h. Microfiche Appendix | m. Searched Column | r. Abstract |
| d. PCT | i. Title | n. PTO-270/328 | <input checked="" type="checkbox"/> Sheets/Figs |
| e. Domestic Priority | j. Claims Allowed | o. PTO-892 | t. Other |

| SPECIFICATION | MESSAGE <u>Sheets/Figs - Fig 12 & 13</u> |
|------------------------|--|
| a. Page Missing | <u>lines in the drawing.</u> |
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FIG. 12

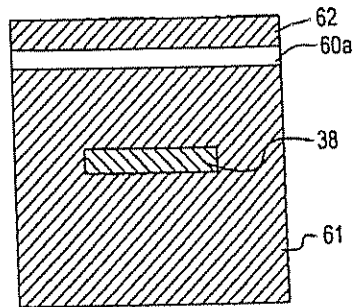
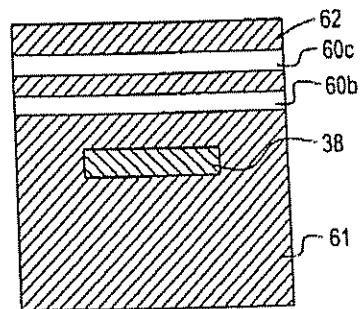


FIG. 13



| | | | | | | |
|---|--|--------------|------------------------------------|---|---------------|--------------------------|
| PATENT APPLICATION FEE DETERMINATION RECORD Effective October 1, 2000 | | | | Application or Docket Number 69814828 | | |
| CLAIMS AS FILED - PART I | | | | | | |
| | | (Column 1) | (Column 2) | | | |
| TOTAL CLAIMS | | 5 | [REDACTED] | | | |
| FOR | | NUMBER FILED | NUMBER EXTRA | | | |
| TOTAL CHARGEABLE CLAIMS | | 5 minus 20= | 0 | | | |
| INDEPENDENT CLAIMS | | 3 minus 3= | 0 | | | |
| MULTIPLE DEPENDENT CLAIM PRESENT | | | | <input type="checkbox"/> | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2 | | | | | | |
| CLAIMS AS AMENDED - PART II | | | | | | |
| | | (Column 1) | (Column 2) | (Column 3) | | |
| AMENDMENT A | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | | PRESENT EXTRA | |
| | Total | • | Minus | •• | = | |
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| AMENDMENT C | CLAIMS REMAINING AFTER AMENDMENT | | HIGHEST NUMBER PREVIOUSLY PAID FOR | | PRESENT EXTRA | |
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| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20"</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1</p> | | | | | | |

SMALL ENTITY TYPE ☐ **OR** **OTHER THAN SMALL ENTITY**

| RATE | FEE | | RATE | FEE |
|-----------|--------|----|-----------|--------|
| BASIC FEE | 355.00 | OR | BASIC FEE | 710.00 |
| X\$ 9= | | OR | X\$18= | |
| X40= | | OR | X80= | |
| +135= | | OR | +270= | |
| TOTAL | | OR | TOTAL | |

SMALL ENTITY TYPE ☐ **OR** **OTHER THAN SMALL ENTITY**

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| X\$ 9= | | OR | X\$18= | |
| X40= | | OR | X80= | |
| +135= | | OR | +270= | |
| TOTAL ADDIT. FEE | | OR | TOTAL ADDIT. FEE | |

| CLAIMS ONLY | | | | | | | SERIAL NO. 09814828 | FILING DATE 3/23/01 |
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| | | | | | | | APPLICANT(S) | |
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* MAY BE USED FOR ADDITIONAL CLAIMS OR AMENDMENTS

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

FORM PTO-3022 (1-98)

United States Patent [19]

Tagawa

[11] 4,287,525

[45] Sep. 1, 1981

[54] MULTI-PIN RECORD ELECTRODE
ASSEMBLY AND DRIVING METHOD OF
THE SAME

[75] Inventor: Takao Tagawa, Kashihara, Japan

[73] Assignee: Sharp Kabushiki Kaisha, Osaka,
Japan

[21] Appl. No.: 943,870

[22] Filed: Sep. 19, 1978

[30] Foreign Application Priority Data

Sep. 21, 1977 [JP] Japan 52-116203
Sep. 22, 1977 [JP] Japan 52-129096[U]
Aug. 28, 1978 [JP] Japan 53-105325

[51] Int. Cl.³ G01O 15/06; G03G 13/00

[52] U.S. Cl. 346/155; 346/139 C;
346/162

[58] Field of Search 346/155, 156, 139 C,
346/162, 163, 165, 153

[56] References Cited

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3,624,661 11/1971 Shebanow 346/155
4,082,619 4/1978 Dehnert 346/155

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2605154 4/1977 Fed Rep of Germany 346/155

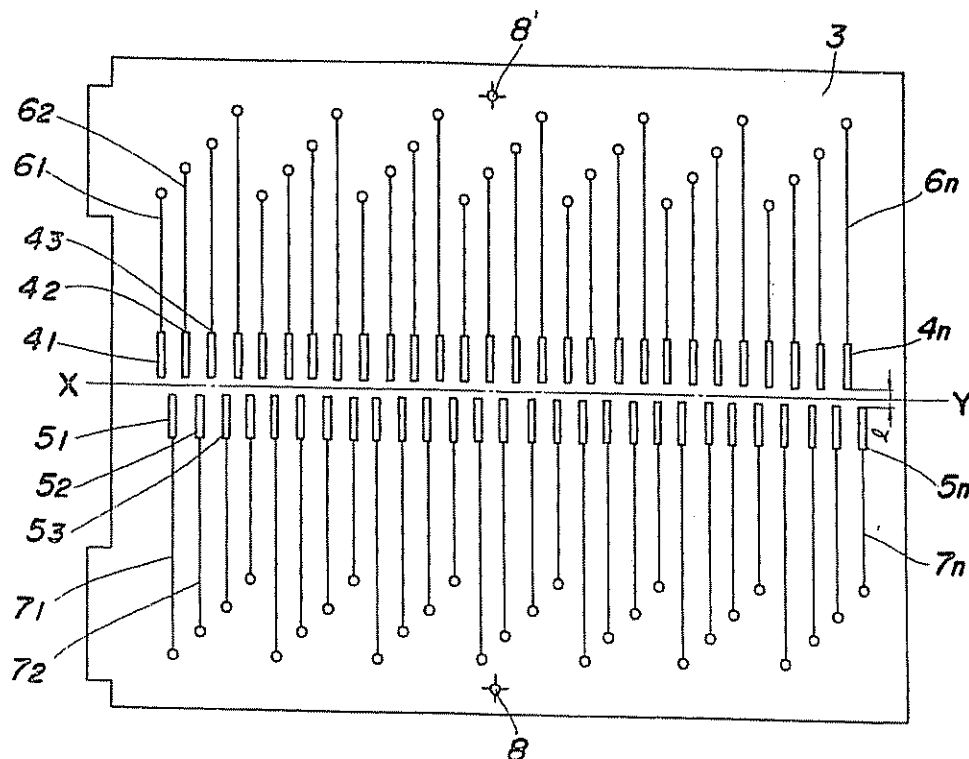
Primary Examiner—Vincent P. Canney

Attorney, Agent, or Firm—Birch, Stewart, Kolasch &
Birch

[57] ABSTRACT

A multi-pin record electrode assembly comprises two series of record electrodes formed on the same substrate and folded to form a zigzag pattern with respect to each other. The electrodes are formed on a flexible substrate having a fold line separating the substrate into two substrate portions. Each substrate portion has an electrode set and its associated leads formed thereon. The substrate is folded along the fold line to produce the record electrode assembly.

9 Claims, 18 Drawing Figures



U.S. Patent Sep. 1, 1981

Sheet 1 of 9

4,287,525

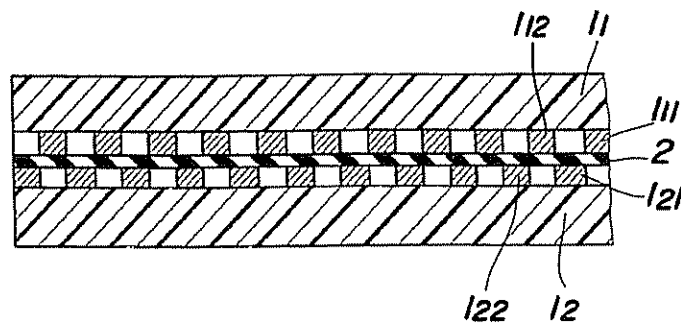


FIG. 1
PRIOR ART

U.S. Patent Sep. 1, 1981

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4,287,525

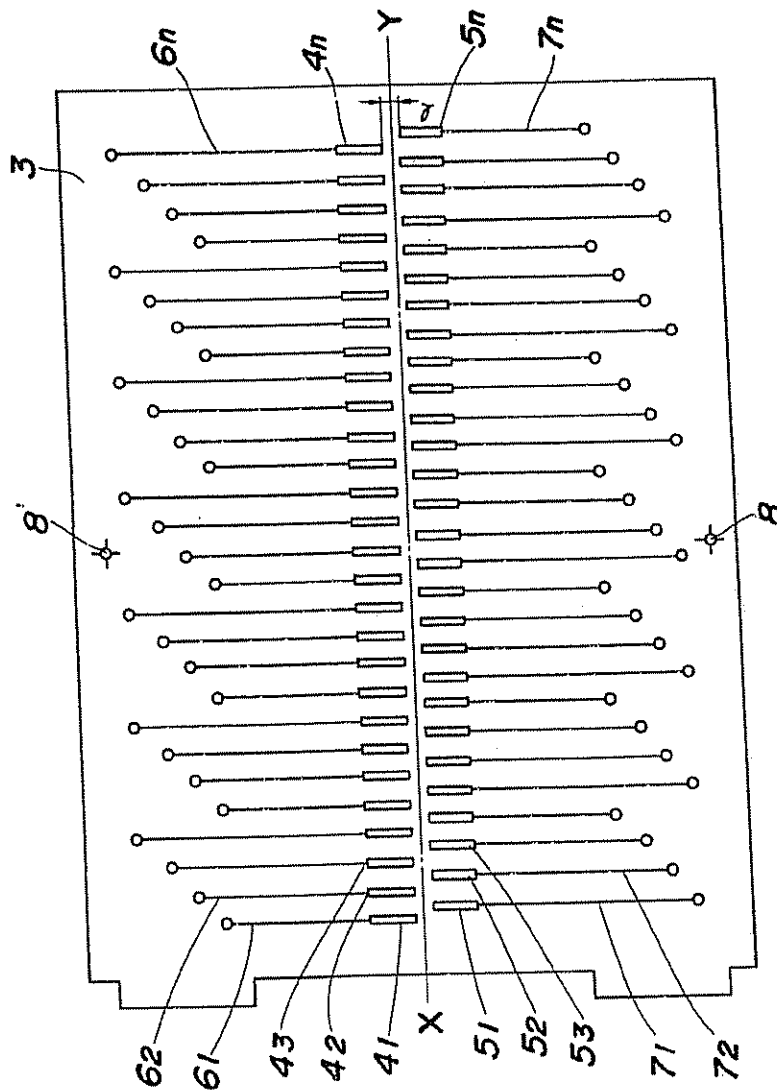


FIG. 2

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Sheet 3 of 9

4,287,525

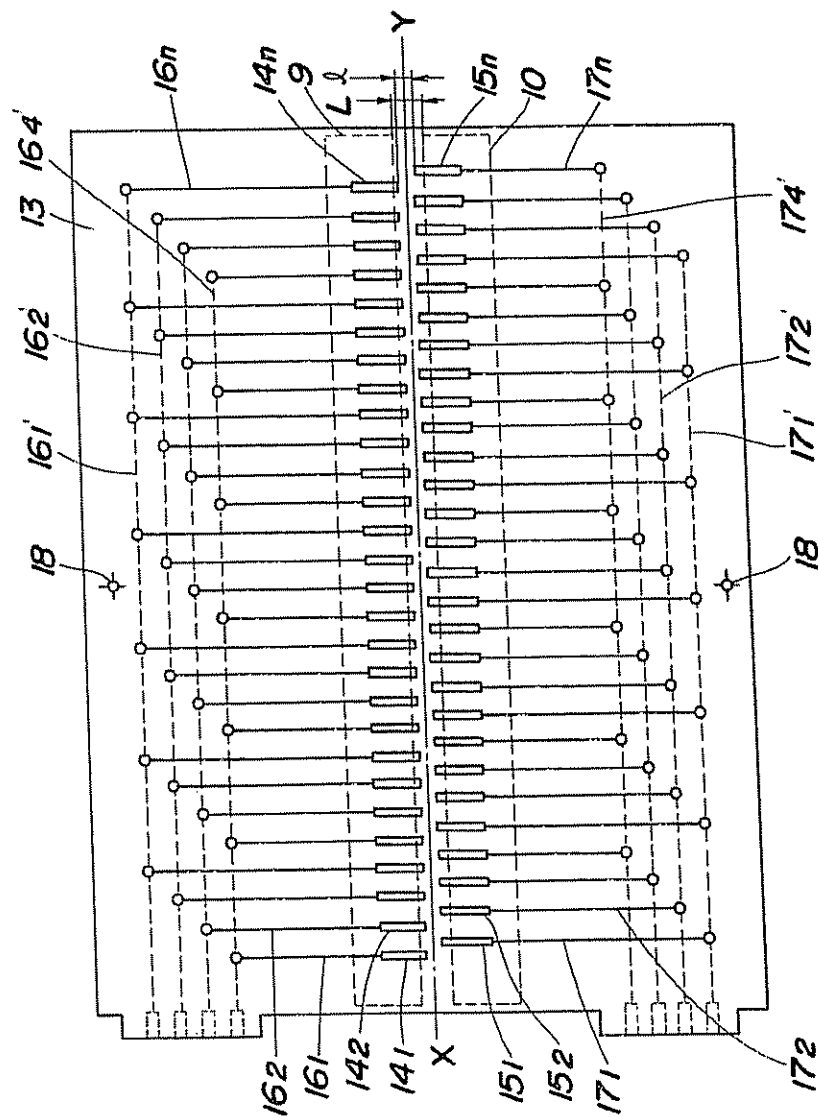


FIG. 3.

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4,287,525

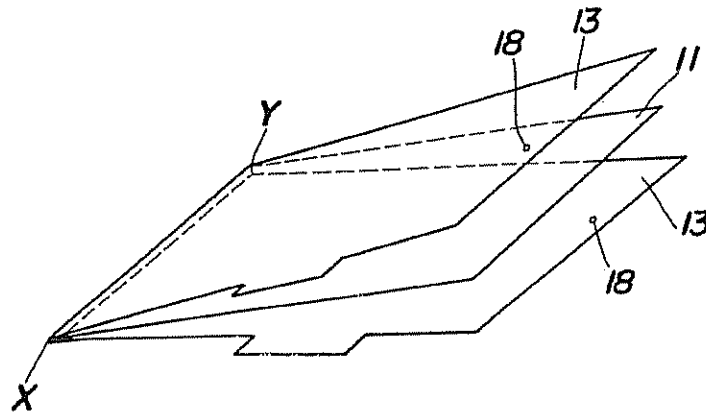


FIG. 4

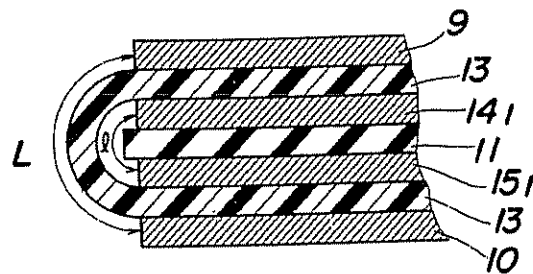


FIG. 5

U.S. Patent Sep. 1, 1981

Sheet 5 of 9

4,287,525

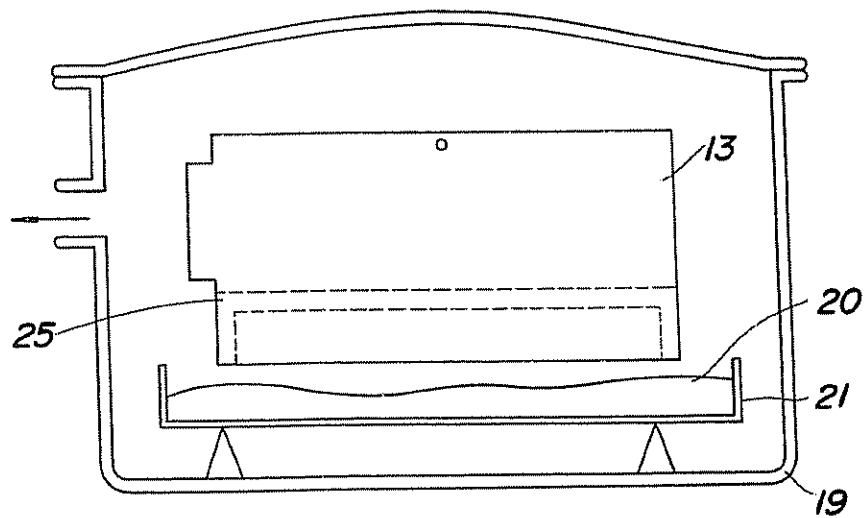


FIG. 6

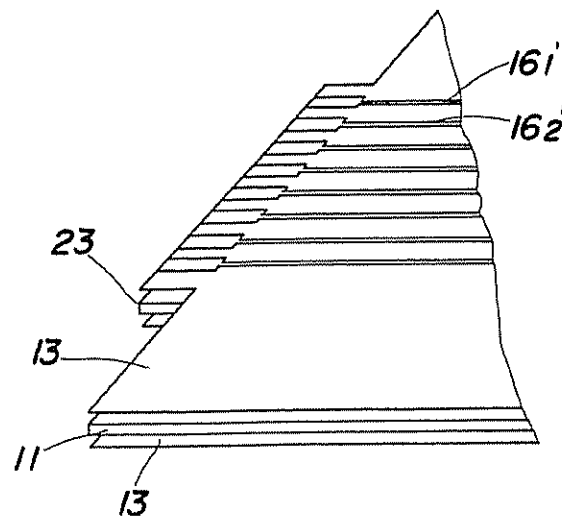


FIG. 7

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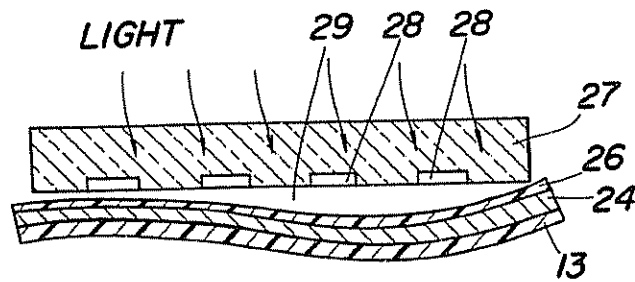


FIG. 8

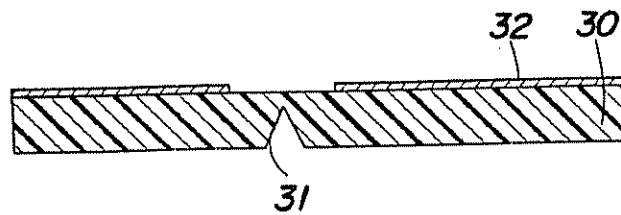


FIG. 9

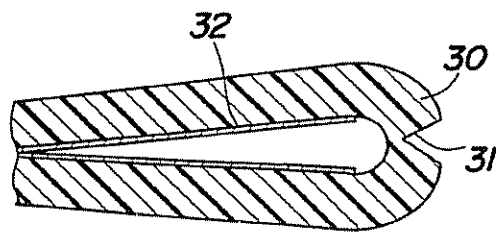


FIG. 10

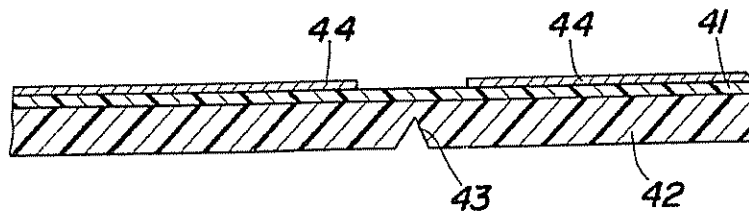


FIG. 11

U.S. Patent Sep. 1, 1981

Sheet 7 of 9

4,287,525

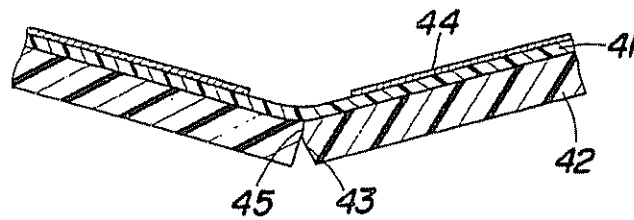


FIG. 12

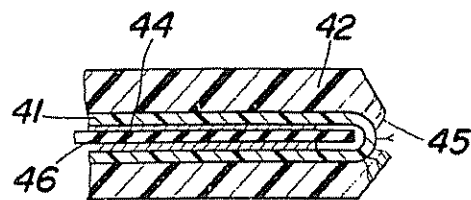


FIG. 13

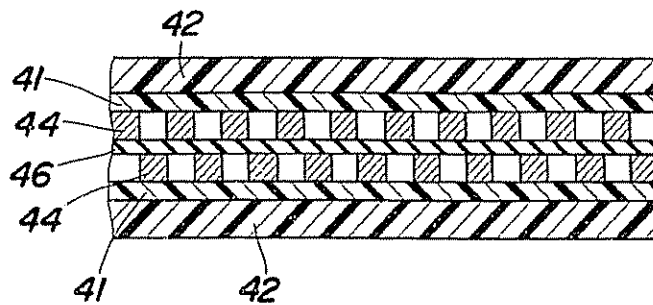


FIG. 14

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4,287,525

FIG .15

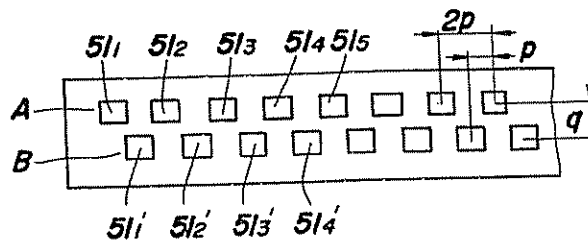
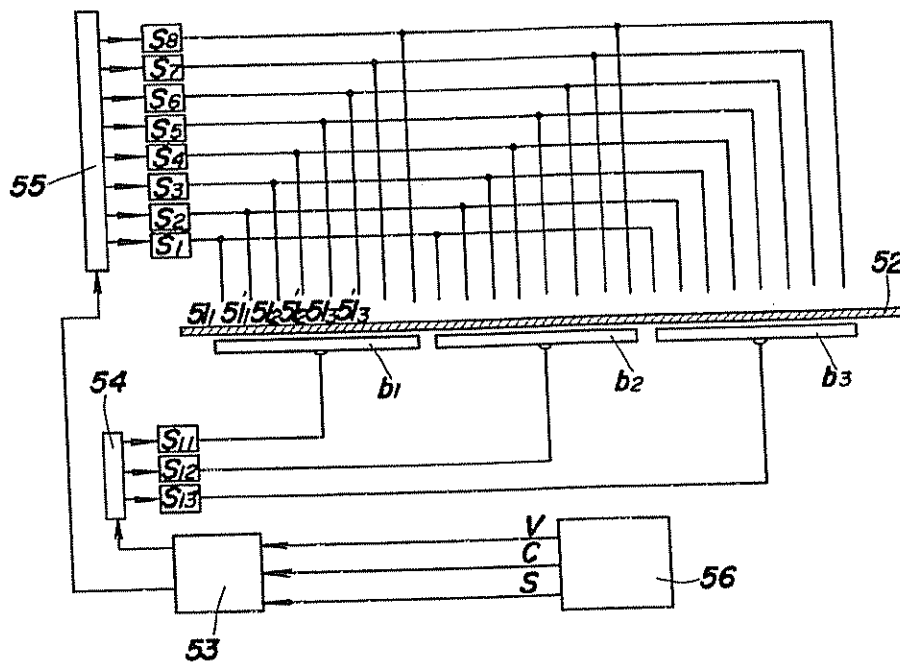


FIG .16

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4,287,525

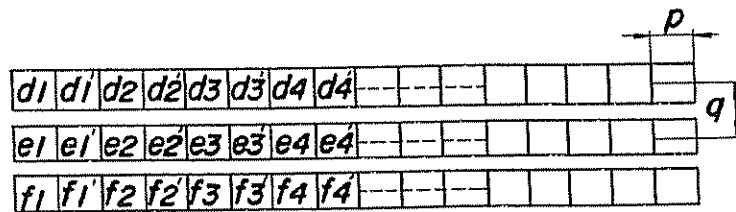


FIG. 17

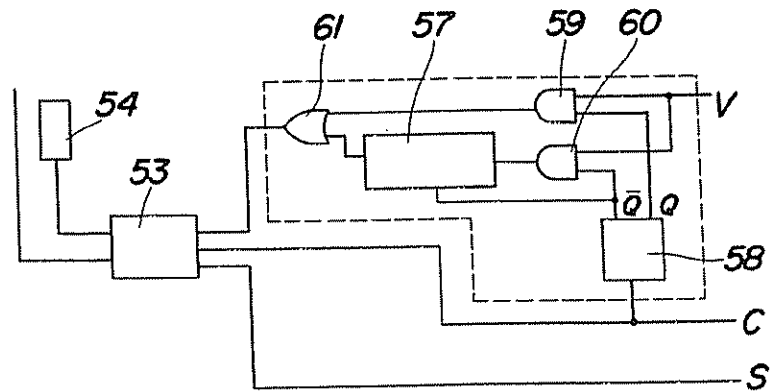


FIG. 18

4,287,525

1

MULTI-PIN RECORD ELECTRODE ASSEMBLY AND DRIVING METHOD OF THE SAME

BACKGROUND OF THE INVENTION

1. Filed of the Invention

The present invention relates to a multi-pin electrode assembly employed as an electrographic recording device and a driving method of the same. The multi-pin electrode assembly has high alignment density of a plurality of pin-shaped stationary record electrodes

2. Description of the Prior Art

A conventional multi-pin electrode assembly is, for example, illustrated in FIG. 1, wherein two recording or printing head substrates 1₁ and 1₂ made of a dielectric plate or dielectric film are adhered to each other. The two recording or printing head substrate 1₁ and 1₂ carry respective equally spaced record electrodes 1₁₁ and 1₁₂, 1₂₁ and 1₂₂, respectively. An insulating layer 2 is interposed between the two arrays of record electrodes 1₁₁ and 1₁₂, 1₂₁ and 1₂₂ which are equally spaced in a zigzag pattern. The two recording or printing head substrates 1₁ and 1₂ are separated from each other.

However, it was impossible to provide a high accuracy of placement of the two recording or printing head substrates due to variations in manufacturing conditions or misalignment.

OBJECTS AND SUMMARY OF THE PRESENT INVENTION

Accordingly, it is the primary object of the present invention to provide an improved multi-pin electrode assembly where a plurality of record electrodes are aligned with high precision.

It is another object of the present invention to provide an improved multi-pin electrode assembly where only one recording or printing head substrate is provided which carries a plurality of equally spaced, two-storied record electrodes in a zigzag pattern.

It is still another object of the present invention to provide an improved multi-pin electrode assembly where an auxiliary rigid substrate is formed on a recording or printing head substrate which carries a plurality of equally record electrodes in a zigzag pattern, whereby the auxiliary rigid substrate can strengthen the record or printing head substrate.

It is further object of the present invention to provide a novel driving method for a multi-pin electrode assembly which carries at least two series each having a plurality of equally spaced record electrodes, where the two series of the equally spaced record electrodes are simultaneously driven according to the present driving method.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

To achieve the above objects, pursuant to one embodiment of the present invention, only one integral recording or printing head substrate is provided which carries two series of a plurality of equally spaced record electrodes. A series of record electrodes is arranged at a half area of the recording or printing head substrate. A

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series of record electrodes is aligned in such a manner as to form a zigzag pattern together with another series of record electrodes. The composed record or printing head substrate is folded at the boundary of the two series of record electrodes. An insulating layer is provided for spacing the two series of record electrode.

To strengthen the recording or printing head substrate, an auxiliary rigid plate is combined with the recording or printing head substrate made of, for example, a resilient film in another preferred form of the present invention.

The resulting multi-pin electrode assembly is driven by the present driving method, where the two series of record electrodes are scanned alternatively, in accordance with a specific memory and timing control circuit of the present invention. The memory stores video signals which are to be applied to the subsequent series of record electrodes, while the video signals are applied to the other series of record electrodes. The timing control circuit functions to read out the video signals stored in the memory and apply the same to the other series of record electrodes.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein;

FIG. 1 is a cross-sectional view of a conventional multi-pin electrode assembly showing a plurality of record electrodes;

FIG. 2 is a top view of a master film adapted to the present invention;

FIG. 3 is a top view of a printed wire board of a multi-pin electrode assembly according to the present invention;

FIG. 4 is a perspective view of the multi-pin electrode assembly shown in FIG. 3 showing a folding process;

FIG. 5 is a cross-sectional view of a center portion of the folded multi-pin electrode assembly;

FIG. 6 is a cross-sectional view of an apparatus for providing the folding process of the present invention;

FIG. 7 is a perspective view of a connector portion of the printed wire board of the present invention;

FIG. 8 is a cross-sectional view of the master film illustrating an exposing process adapted to the present invention;

FIGS. 9 and 10 are cross-sectional views of a conventional multi-pin electrode assembly;

FIGS. 11 to 13 are cross-sectional views of another multi-pin electrode assembly according to the present invention;

FIG. 14 is a cross-sectional view of the multi-pin electrode assembly shown in FIGS. 11 to 13 showing a plurality of record electrodes;

FIG. 15 is a schematic wiring diagram of a principle electrographic recording device;

FIG. 16 is a top view of an enlarged scale of the record electrodes of the present invention;

FIG. 17 is a schematic record pattern adapted to a driving method of the present invention; and

FIG. 18 is a block diagram of a circuit configuration of a driving method of the present invention.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

Although a multi-pin electrode assembly of the present invention is applicable to an electrographical recording device such as a thermal printing, an electrostatic recording or the like, only the electrostatic recording is described herein for the sake of convenience.

FIG. 2 shows a master film 3 in a top view. The master film 3 is provided for composing patterns 4₁ to 4_n and 5₁ to 5_n for a plurality of equally spaced record electrodes and patterns 6₁ to 6_n and 7₁ to 7_n for lead lines on a record or printing head substrate of a flexible printed circuit board. The two series of patterns 4₁ to 4_n and 5₁ to 5_n for the record electrodes are, respectively, aligned on the half area of the master film 3 spaced by the center line X-Y. The situation is the same as the two series of patterns 6₁ to 6_n and 7₁ to 7_n. The patterns 4_n and 5_n are both separated from the center line X-Y at an interval of 1/2. The two series of the patterns 4_n to 5_n are physically shifted the width of each pattern with respect to each other. In other words, the two series of patterns 4_n and 5_n are composed in a zigzag pattern with respect to each other so that they form a zigzag pattern of the record electrodes in the multi-pin electrode assembly of the present invention.

The patterns 4_n and 5_n are divided to a plurality of groups each consisting of a predetermined number of the patterns 4_n and 5_n, in a preferred form, four patterns 4_n and 5_n. The length of the patterns 6_n relates to a group of the four patterns 4_n is subsequently changed while the length of the another patterns 7_n relates to a group of the four patterns 5_n is also subsequently changed in such a manner as to be symmetric to the length of the patterns 6_n. When the record electrodes and the lead lines are confronted with the other record electrodes and the lead lines, capacitance defined by the record electrodes and the lead lines becomes uniform. A pair of patterns 8 and 8' for pin holes are formed on the master film 3 for precisely positioning the master film 3 while it is folded.

FIG. 3 illustrates conductive patterns formed on a printed circuit board (P.C.) 13 using the master film 3 shown in FIG. 2. The P.C. 13 is preferably a flexible plate made of, for example, polyimide. A photosensitive material covers the P.C. board 13, whereby record electrodes 14_n and 15_n and lead lines 16_n and 17_n are patterned by a conventional photo etching process, screen printing or the like, according to the patterns formed on the master film 3. Two metal films 9 and 10 are arranged on the back of the P.C. board 13 for facilitating the manufacturing process of the conductive patterns and enhancing the recording characteristic of the recording head. The two metal films 9 and 10 are respectively spaced from the center line X-Y at L/2 (L > 1). The heads of the record electrodes 14_n and 15_n are mechanically protected by the two metal films 9 and 10. The metal films 9 and 10 prevent P.C. board 13 from shrinking to prevent damage to the conductive patterns while the photo etching process is conducted.

A series of second lead lines 16₁' to 16₄' are commonly connected to the respective lead lines 16_n through through-holes formed within the P.C. board 13 at the tips of the lead lines 16_n, the lead lines 16 having equivalent positioning in their groups of the lead lines 16. Another series of second lead lines 17₁' to 17₄' is the same as the above. Terminals of the second lead lines 16₁' to 16₄' and 17₁' to 17₄', are formed on the edge of

the P.C. board 13, where the recording head is connected to another instrument for driving purposes.

The P.C. board 13 is folded at the center line X-Y to compose the recording head as best shown in FIG. 4 so that the record electrodes 14_n and 15_n and the lines 16_n and 17_n are confronted through a thin spacer 11. The pin holes 18 and 18' functions to facilitate and enhance the positioning in the folding process.

A folding line is formed along the center line X-Y to facilitate the folding process.

FIG. 5 shows the tip of the record head beside the center line X-Y in a cross-sectional view on an enlarged scale. As best shown in FIG. 5, the following relationship is most preferable between the spacings L and l, the spacer 11, the record electrodes 14_n and 15_n, and the P.C. board 13.

$$l = \frac{\pi}{2} (a + 2t)$$

$$L = \frac{\pi}{2} (a + 2b + 2t)$$

wherein a, b, and t are the thickness of the spacer 11, and the P.C. board 13, and the record electrodes 14_n and 15_n, respectively.

It is preferable that the values of the spacings L or l be from one half to twice the above most preferable values defined by the above equations.

The record electrodes 14_n and 15_n are arranged in a zigzag pattern by the above-mentioned folding process. It is an important process in the folding process that the P.C. board 13 is adhered to itself through the spacer 11. An insulating material such as lacquer can be substituted for the plate-shaped spacer 11. The opposed surface of the P.C. board 13 is covered with the insulating material before it is folded.

FIG. 6 illustrates an apparatus for conducting the adhesion process of the folded P.C. board 13. The P.C. board 13 is coated with adhesive except on the tips of the record head beside the center line X-Y. In other words, the area 25 of the P.C. board 13 enclosed by dashed lines has the adhesive. The P.C. board 13 is adhered to each other through the spacer 11.

The P.C. board 13 is positioned within a vacuum container 19 of a vacuum system. A pan 21 containing adhesive such as epoxy resin 20 is also disposed within the vacuum container 19. At first, the P.C. board 13 is separated from the epoxy resin 20. The vacuum container 19 is placed into high vacuum conditions. Therefore, bubbles contained within the epoxy resin 20 or the P.C. board 13 are removed. Thereafter, the tip of the record head e.g. P.C. board 13 is slowly deposited in the epoxy resin 20. The vacuum operations are terminated to make the vacuum container 19 atmospheric pressure.

The epoxy resin 20 is injected into the P.C. board 13 through the folding line, the epoxy resin containing no bubble of such as a gas or the like. If the bubble remains beside the record electrodes 14_n or 15_n, the bubble reduces the value of voltage applied to the record electrodes 14_n or 15_n. Sometimes, the recording head may be damaged. The manufacturing process described above is suitable for the mass production of high quantities of the record head because only one master film 13 is utilized for conducting the photo etching process to the only one P.C. board 13 and, thereafter, the P.C. board 13 is folded to compose the recording head.

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The metal films 9 and 10 can be removed by etching process. Otherwise, they are effectively available for the following features. An electrostatic capacity is produced between the record electrodes 14_n and 15_n and the metal films 9 and 10 by holding the metal films 9 and 10 at a ground or a predetermined voltage. According to the electrostatic capacity, an induced voltage is reduced which is produced beside the adjacent record electrodes 14_n or 15_n by the now switching record electrodes 14_n or 15_n, as follows.

The induced voltage V' produced on the record electrode j is written by the following equation

$$V' = \frac{C_1}{C_1 + C_2} V$$

wherein V is the voltage of the now switching record electrode i, C₁ is the electrostatic capacity between the record electrode i and the adjacent record electrode j, and C₂ is the electrostatic capacity between the metal films 9 and 10 and the record electrodes i and j.

The effect of the reduction of the induced voltage can be expected at an auxiliary electrode side when the auxiliary electrode is utilized for conducting the electrostatic recording.

At the tip of the recording head of the P.C. board 13, the recording electrode 14_n and 15_n form the zigzag pattern spaced by the spacer 11 which is very thin. Therefore, it is not preferable that a terminal portion of the record head be also manufactured at the same thickness as the tip of the recording head because the terminal portion is connected to another driving instrument.

FIG. 7 shows a preferred form of the terminal portion where an auxiliary spacing plate made of, for example, bachelite resin is provided for appropriately spacing the P.C. board 13.

The recording head including the record electrodes 14_n and 15_n is molded by suitable synthetic resin for fixing and protecting purposes. Unnecessary synthetic resin for exposing the tip of the recording head and the P.C. board 13 beside the center line X-Y are both removed by polishing process to provide the multi-pin electrode assembly of the present invention.

In another preferred form of the present invention, an auxiliary rigid film is attached to the flexible P.C. board 13. This another preferred form of the present invention is described hereinafter with reference to the drawings.

FIG. 8 illustrates the exposing procedure of the photo etching process adapted to the P.C. board 13 of the present invention as previously described. A photo resist 26 is coated on the P.C. board 13. A master pattern 27 made of, for example, glass material is disposed on the photo resist 26 for producing patterns corresponding to patterns 28 formed on the master pattern 27 in accordance with the exposing procedure. A mask is produced on the photo resist 26 disposed on the P.C. board 13 by the master pattern 27, the mask being utilized for etching a metal film 24.

A spacing 29 is unavoidably produced due to the flexibility of the P.C. board 13 as best shown in FIG. 8. The spacings 29 reduce the accuracy of the etching process thereby reducing the high integration of the recording head.

FIG. 9 illustrates another construction of the P.C. board 30 of the type where the P.C. board 30 comprises a rigid plate. A notch 31 is formed in the P.C. board 30 for readily folding the P.C. board 30. A metal film 32 is disposed on the P.C. board 30. The metal film 32 under-

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goes the abovementioned etching process. However, the P.C. board 30 may be broken by the folding process. Otherwise, the P.C. board 30 inevitably widens beside the center of the folding line as best shown in FIG. 10. Thus it is impossible to manufacture a suitable recording head.

FIG. 11 shows a construction of the P.C. board in another preferred embodiment of the present invention, wherein the P.C. board comprises a flexible film 41 made of, for example, polyimide with a thickness of 20-100 μm and a rigid printed wire board 42 made of, for example, glass epoxy resin. The rigid printed circuit board 42 has toughness coefficient larger than the flexible film 41. A notch 43 is formed in the rigid printed circuit board 42 for facilitating the folding process applied to the combination of the flexible film 41 and the rigid printed circuit board 42. A metal film 44 made of, for example, copper is disposed on the flexible film 41. The metal film 44 is processed with the photo etching process so that a plurality of conductive patterns are formed on the flexible film 41. The conductive patterns are similar as shown in FIG. 3.

The P.C. board comprising the flexible film 41 and the rigid printed circuit board 42 is folded to compose the record head of the present invention as viewed in FIG. 12. Cracks 45 are unavoidably produced within the rigid printed circuit board 42 due to the hardness of the same. However, the cracks 45 can not extend into the flexible film 41 because of the flexibility of the flexible film 41.

The recording head shown in FIG. 13 is derived from the abovementioned manufacturing procedures as illustrated in FIGS. 11 and 12. An insulating layer 46 is provided for spacing the metal films 41.

The recording head shown in FIG. 14 comprises a plurality of recording electrodes in the zigzag pattern as similar as in FIG. 1. The record head depicted in FIG. 14 is manufactured by the similar manufacturing process as described previously with reference to FIGS. 2 to 7.

Attention is directed to an improved driving method of the abovementioned recording head of the present invention described hereinafter. The driving method of the present invention is described utilizing the recording head having an auxiliary electrode behind the record or printing head substrate although this embodiment not limited by the construction of the recording head.

FIG. 15 illustrates a block diagram of a conventional driving system for a conventional recording head. A logic circuit 53 receives video signals V, clock signals C, and synchronizing signals S. Picture element signals as the video signals V are impressed in serial to the logic circuit 53 in this description. It is possible to apply the picture element signals in parallel to the logic circuit 53 with a plurality of bits. A conversion circuit be required to convert parallel information to serial information, the conversion circuit being included within the logic circuit 53.

In FIG. 15 a plurality of record electrodes are referred to 51₁, 51₁', 51₂, 51₂' and so forth. Such record electrodes are related to the above-mentioned record electrodes 14_n and 15_n, respectively. A plurality of auxiliary electrodes b₁, b₂ and b₃ are disposed behind the record electrodes 51₁, 51₁', and so forth.

A recording paper 52 is positioned between the record electrodes 51, 51₁' and so on and the auxiliary

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electrodes b_1, b_2 and b_3 . A plurality of switching circuits S_1 to S_8 are provided for controlling applied voltages to the recording paper 52. A voltage of approximately -300 V is impressed to the recording paper 52 by the switching circuits S_1 to S_8 at the on conditions. Another series of switching circuits S_{11}, S_{12} , and S_{13} functions to control applied voltages to the auxiliary electrodes b_1 to b_3 . A voltage of approximately $+300$ V is applied to the auxiliary electrodes b_1 to b_3 at the on conditions.

It is assumed that recording operations are carried out by signals derived from a signal generator 56 using the record electrodes $51_1, 51'_1, 51'_2$ and so on except for the record electrodes 51_2 . The switching circuit S_3 should be turned off while the remaining switching circuits S_1, S_2, S_4 and so forth should be turned on. Simultaneously the switching circuit S_{11} should be turned on while the remaining switching circuits S_{12} and S_{13} are turned off.

When it is further assumed that a record pattern depicted in FIG. 17 is carried out, the two series of record electrodes $51_1, 51'_1, 51_2, 51'_2$ and so on are alternatively scanned in accordance with the conventional driving method. That is, odd-numbered record electrodes of the first series of record electrodes $51_1, 51_2, 51_3$ and so on are firstly scanned and, thereafter, even-numbered record electrodes are driven. Odd-numbered record electrodes of the second series of record electrodes $51'_1, 51'_2, 51'_3$ and so forth are subsequently scanned and, thereafter, even-numbered record are driven. Two cycles of scanning operation are required to record data corresponding to a line so that recording rate of the recording head becomes a half of another type of the recording head including a line of the recording electrodes.

The present driving method, now, is described with reference the drawings in detail.

A circuit enclosed by dashed lines in FIG. 18 is coupled between the signal generator 56 and the logic circuit 53 shown in FIG. 15. AND gates 59 and 60 have the video signals V . A flip-flop 58 receives the clock signals C and develops the outputs Q and \bar{Q} respectively applied to the AND gates 59 and 60. The video signals transferred from the AND gate 59 is applied to the logic circuit 53 through an OR gate 61. The video signals developed from the AND gate 60 is transferred to a shift register 57 to be applied to the logic circuit 53 through the OR gate 61 after once stored in the shift register 57.

The shift register 57 is wired so that it memorizes video signals corresponding to at least one line data of the two series of the record electrodes $51_1, 51'_1$ and so forth. The output Q generated from the flip-flop 58 is applied to the shift register 57 so as to control shift operation of the shift register 57.

In operation, it is assumed that the record pattern shown in FIG. 17 is carried out. The signal generator 56 develops subsequently two series of video signals $f_1, f'_1, f_2, f'_2, \dots, f_n, f'_n$ and $e_1, e'_1, e_2, e'_2, \dots, e_n, e'_n$ in the order that the record operations are carried out. Odd-numbered video signals f_1, f_2, f_3 and so forth are firstly scanned through the AND gate 59 and the OR gate 61 using the clock signals C and the flip-flop 58. Even-numbered video signals f'_1, f'_2, f'_3 and so on are once stored in the shift register 57 by the clock signals C and the flip-flop 58.

Since the shift register 57 has storage capacity corresponding to a series of record electrodes 51_1 to 51_n , information according to odd-numbered video signals is

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utilized for recording purposes while information according to even-numbered video signals is stored in the shift register 57 when information for the first series of record electrodes 51_1 to 51_n is developed. Under these circumstances the recording paper 52 is advanced at a length q .

Thereafter, information applied to the second series of record electrodes $51'_1$ to $51'_n$ is generated from the signal generator 56. At that time, odd-numbered video signals e_1, e_2, e_3 and so forth are applied to odd-numbered switching circuits S_1, S_3, S_5 , and so on. Simultaneously, the shift register 57 develops the stored even-numbered video signals f'_1, f'_2, f'_3 and so on. Therefore, the OR gate 61 receives alternatively the even-numbered video signals f'_1, f'_2, f'_3 and so on and the odd-numbered video signals e_1, e_2, e_3 and so forth. Even-numbered switching circuits S_2, S_4, S_6 and so on have the above-mentioned video signals $f'_1, f'_2, f'_3, e_1, e_2, e_3$ and so on.

As the switching circuits S_{11}, S_{12} and S_{13} are subsequently driven, dot positions corresponding to f'_1, f'_2, f'_3 and so on of the first series of record electrodes are recorded between the intervals of dot positions corresponding f_1, f_2, f_3 and so on of the same and, simultaneously, the dot positions corresponding to e_1, e_2, e_3 and so on of the second series of record electrodes are recorded. The shift register 57 develops the information for the even-numbered dot positions corresponding to f'_1, f'_2, f'_3 and so on of the first series and, simultaneously, stores the information for the even-numbered dot positions corresponding to e'_1, e'_2, e'_3 and so on of the second series. When the first series of record electrodes has completed the recording for the information of the odd-numbered dot positions corresponding to e_1, e_2, \dots, e_n , the second series of record electrodes has simultaneously completed the recording for the information of the dot positions corresponding to f'_1, f'_2, f'_3 and so on. Then the shift register 57 stores the information for the even-numbered dots positions corresponding to e'_1, e'_2, e'_3 and so on of the second series.

As described above, data for even-numbered dot positions in a scanning record line are being stored in the shift register 57 when the data for odd-numbered dot positions in the same are being recorded. Simultaneously, the data for the even-numbered dot positions in the preceding scanning record line are being recorded alternatively together with the data for the odd-numbered dot positions in the above-mentioned scanning record line. The present driving method achieves the recording at two times the rate of the above-mentioned conventional driving method.

The data for the even-numbered data positions at the last record line may remain within the shift register 57 while the data for the odd-numbered data positions of the same are completely recorded. To eliminate the problem, it is necessary to be absence of the data for the data positions at the last scanning record line. An auxiliary advancement of the recording paper 52 may be available for causing the absence of the data for the data positions at the last scanning record line. Otherwise, the signal generator 56 is wired so as to provide additional signals for causing the absence of the data after the recording operations are completed.

Although the shift register 57 is utilized for conducting delay operations, a pair of random access memories (RAM) can be substituted for the shift register 57. One of the RAMs receives the information for the data posi-

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tions while the other provides the information for the data positions previously stored

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications are intended to be included within the scope of the following claims.

What is claimed is:

1. A multi-pin record electrode assembly comprising: an insulating substrate folded into two substrate portions along a fold line; and

first and second electrode sets formed on said substrate along said fold line, said first electrode set including a plurality of closely spaced electrodes arranged at a predetermined distance from each other along a first side of said fold line, said second electrode set including a plurality of closely spaced electrodes arranged at said predetermined distance from each other along a second side of said fold line, said second electrode set being offset along said fold line from said first electrode set approximately one half said predetermined distance said electrodes of each set are spaced from each other; said substrate being folded so as to form a record electrode assembly having an edge formed along said fold line, said first and second electrode sets having alternating electrodes presented along said edge.

2. The electrode assembly of claim 1, wherein said first and second substrate portions each have inner surfaces juxtaposed to each other when said substrate is folded, said inner surface of said first substrate portion

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being folded to lie substantially coplanar to the inner surface of said second substrate portion.

3. The electrode assembly of claim 2, wherein said first and second electrode sets are formed on the inner surfaces of said first and second substrate portions, respectively.

4. The electrode assembly of claim 3, further comprising:

an insulating film disposed between the inner surfaces of said first and second substrate portions for electrically isolating said first and second electrode sets from each other

5. The electrode assembly of claim 2, further comprising:

lead lines connected to each electrode of said first and second electrode sets, each of said lead lines extending perpendicularly from said fold line and parallel to each other.

6. The assembly of claim 2, further comprising: a shield disposed on the outer surface of each of said first and second substrate portions to electrostatically isolate said first and second electrode sets.

7. The multi-pin record electrode assembly according to claim 1, wherein said substrate is flexible.

8. The assembly of claim 1, further comprising: an auxiliary substrate bonded to the outer surface of said substrate portions, said auxiliary substrate being relatively rigid.

9. The electrode assembly of claim 1, wherein each of said electrodes has a width along said fold line approximately equal to said predetermined distance between adjacent electrodes, said electrodes of said first and second electrode sets alternating so as to substantially continuously cover the length of said fold line upon which said first and second electrode sets are disposed.

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United States Patent [19]

Takamatsu et al.

[11] Patent Number: 4,474,432

[45] Date of Patent: Oct. 2, 1984

[54] OPTICAL DISPLAY PANEL STRUCTURE

[56]

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[30] Foreign Application Priority Data

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[51] Int. Cl.³ G02F 1/13

[52] U.S. Cl. 350/339 R; 350/333;
350/336; 350/332

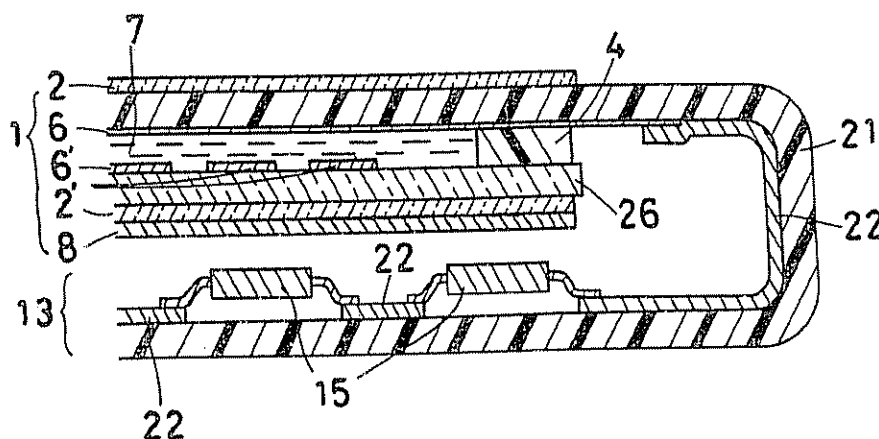
[58] Field of Search 350/331 R, 332, 334,
350/336, 339 R, 333

[57]

ABSTRACT

A liquid crystal display cell includes two opposing substrates at least one of which is made of a highly polymerized transparent compound film. The transparent film is extended from the liquid crystal display cell. Wiring patterns are formed on the thus extended portion of the transparent film. Semiconductor circuit elements for driving the liquid crystal display cell are mounted on the extended portion of the transparent film and electrically connected to the wiring patterns.

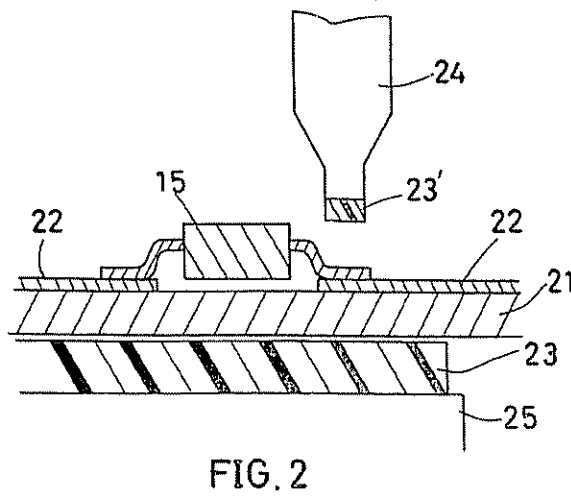
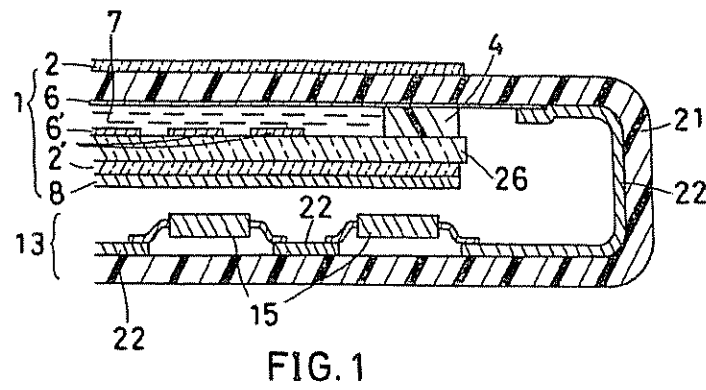
4 Claims, 4 Drawing Figures



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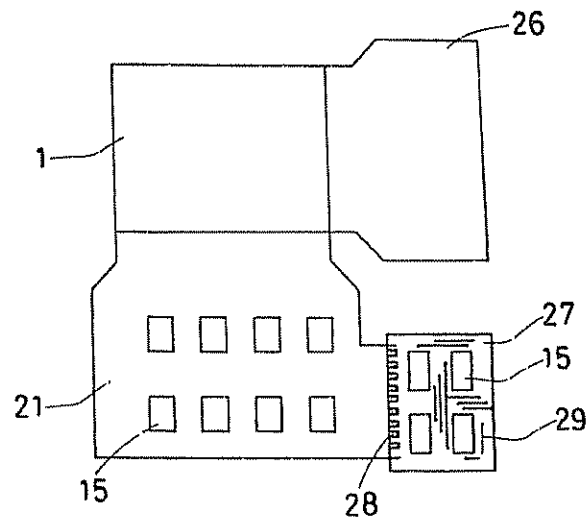


FIG. 3

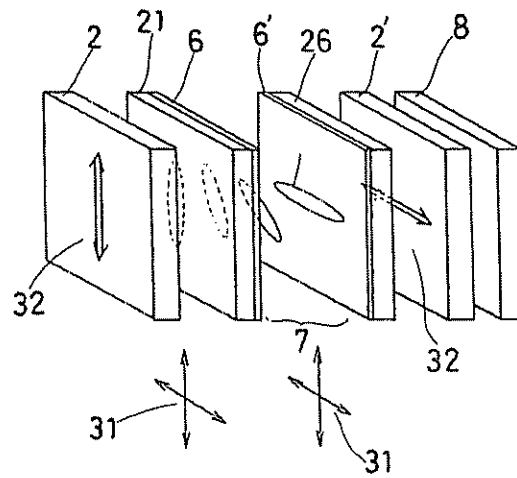


FIG. 4

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OPTICAL DISPLAY PANEL STRUCTURE

BACKGROUND OF THE INVENTION

The present invention relates generally to an optical device and, more particularly, to a structure for an optical display panel such as a liquid crystal display panel.

Recently, an optical display panel such as a liquid crystal display panel, has been proposed with an improved terminal connection structure. See, for example, copending U.S. patent application, Ser. No. 188,562, filed on Sept. 18, 1980 by F. Funada et al. entitled "ELECTRODE TERMINAL ASSEMBLY ON A MULTI-LAYER TYPE LIQUID CRYSTAL PANEL".

A United Kingdom counterpart was filed, also on Sept. 18, 1980, as patent application No. 8030273 and a West German counterpart was filed on the same day as Patent Application No. P 30 35 268.2. The disclosure of each of these patent applications is incorporated herein by reference.

A purpose of recent development efforts as shown by each of these patent applications is to provide an electrode lead scheme that is easy to manufacture and handle, the scheme including a very large number of terminals for connecting an optical cell such as a liquid crystal display device, to a power source.

However, the prior art electrode lead structures inclusive of each of the above-identified patent applications could not provide excellence with respect to, for example, the small mass or thinness of the optical cell.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved optical display panel such as a liquid crystal display

It is another object of the present invention to provide such an improved optical display panel with a very large number of terminals, the panel being very compact and very thin.

Other objects, advantages, features and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the following detailed description.

To achieve the above objects, pursuant to a preferred embodiment of the present invention, at least one substrate of a liquid crystal display panel is made of a transparent highly polymerized compound film. The transparent highly polymerized compound film is extended from the panel section to support the semiconductor circuit elements. Electrodes for the liquid crystal display panel are formed on the transparent highly polymerized compound film in the panel section and electrically connected to the semiconductor circuit elements via wiring patterns formed directly on the transparent highly polymerized compound film.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be better understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illus-

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tration only, and thus are not limitative of the present invention and wherein:

FIG. 1 shows a cross sectional view of an optical display panel, such as a liquid crystal display panel, according to the present invention;

FIG. 2 shows a cross sectional view taken during a step of a manufacturing process used for producing the panel assembly of FIG. 1;

FIG. 3 shows a plan view of another type of optical display panel according to the present invention; and

FIG. 4 shows an exploded perspective view of the optical display panel of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Now with specific reference to FIG. 1, an optical display panel embodying the present invention includes a film 21 composed of a highly polymerized compound such as a polyethyleneterephthalate film, for example, "DIAFOIL" manufactured by Mitsubishi Plastic Industries Ltd., a polycarbonate film manufactured by, for example, Toray Industries Company, a polyvinylidene-fluoride film manufactured by, for example, Asahi Glass Co., Ltd., and a tetrafluoroethylene hexafluoropropylene copolymer film manufactured by, for example, Asahi Glass Co., Ltd. Each of these compounds is transparent, flexible with an appropriate degree of rigidity, and thermally stable. The film 21 supports an optical display panel such as a matrix type liquid crystal display panel, and a driver circuit therefor.

FIG. 2 shows a step of a manufacturing process employed to complete the display assembly as shown in FIG. 1, wherein a semiconductor circuit element is coupled or adhered to a conductive coating by thermal bonding.

Returning to FIG. 1 with greater particularity, the film 21 composed of a highly polymerized transparent compound is provided as a substrate for a control circuit unit 13 and for a liquid crystal display panel 1. The film 21 supports a plurality of transparent electrodes 6 functioning as the column electrodes of the liquid crystal display panel 1 manufactured by a process whereby conductive and patterned electrodes made of, e.g., In_2O_3 are formed. The conventional orientation procedures such as rubbing or slant evaporation are applied thereon after an insulating film, such as SiO_2 , is formed.

A wiring pattern 22 is provided for connecting the transparent electrodes 6 to a driver circuit comprising one or more active or passive elements such as an IC. A suitable conductive coating composition is deposited on the film 21 by screen printing or the like. The thus deposited coating film is dried to form the pattern 22. Preferred examples of the conductive coating composition are made by mixtures of the following substances:

1. Metallic or non-metallic conductive materials:
Powdered Ag, Au, or C
2. Fixer:
Chloroprene-rubber;
Chlorosulfonate-rubber;
Polyurethane; or
Vinyl acetate ethylene copolymer
3. Binder:
Dimethylformamide;
Dimethylacetamide;
Diethyl carbitol;
Butyl carbitol;
Carbitol;

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Turpentine oil;
Pine oil;
Ethylene glycol;
Glycerol;
Butyl acetate;
Cellosolve; or
Cellosolve acetate

Usually, the powdered carbon particles are used. To provide a low resistivity for the electrode, a first layer can be printed containing powdered silver particles and a second layer can be printed thereover containing the powdered carbon particles.

A conventional transparent counter substrate 26, formed from conventional transparent material carries patterned electrodes 6', as row electrodes, which have insulating films thereon through the application of liquid crystal orientation techniques. On the other surface of the substrate 26, a polarizer 2' and a reflection plate 8 are disposed. Then, the substrate 26, as a counter substrate, is positioned opposite to the film 21 with an appropriate distance therebetween to provide a cavity closed laterally by a sealing element 4. The element 4 is disposed around the periphery of the cavity to define the liquid crystal display cell.

Another polarizer 2 is disposed on the film 21 at the other side from the substrate 26. Liquid crystal material 7 is injected within the cavity between the film 21 and the substrate 26. Thus, a liquid crystal display panel 1 of the matrix electrode type is formed comprising the film 21, the substrate 26, the transparent electrodes 6 and 6', the polarizers 2 and 2', the sealing element 4, the reflection plate 8, and the liquid crystal mixture 7.

To provide an accurate separation between the film 21 and the substrate 26, powdered glass fiber particles may be dispersed within the display area of the cavity; however they must be removed before the liquid crystal mixture 7 is injected by vacuum injection. If it is possible that the liquid crystal molecular orientation treated layer may be removed or damaged mechanically while printing the wiring pattern 22, it may be necessary to coat the orientation treated layer with a film of "SILITECT", manufactured by Controlyne Inc., or to dispose an appropriate film on the display area of the display 1. These protective films should be removed after printing the wiring pattern 22.

Instead of the above manufacturing process, another process may be applied, e.g., one comprising steps of making the liquid crystal display panel assembly 1 by patterning the electrodes, evaporating the insulating layers, and treating the liquid crystal molecule orientation process, and the final step of printing the wiring pattern

An IC 15 inclusive of passive and active circuit elements forming a driver circuit is connected to the wiring pattern 22 formed on the film 21 by the following steps, with reference to FIG. 2. A cushioned material 23 such as a rubber plate is disposed on a supporting table 25. The film 21 is disposed on the cushioned material 23. On the film 21, the wiring pattern 22 is disposed on which the IC 15 is arranged appropriately. A thermal head 24 having a cushioned material 23' such as a rubber at its tip, presses, with an appropriate temperature such as about 150° to 180° Centigrade, leads coupled to the IC 15 against the wiring pattern 22. Electrical connection between the leads and the wiring pattern 22 is facilitated with the help of resin within the wiring pattern, which is readily adhered to the pattern 22. Thus, the driver circuit 13 is completed

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This arrangement is featured in that the film 21 functions as a transparent substrate for the column electrodes 6 of the liquid crystal display panel 1 and that, because of the flexibility of the film 21, the display panel 1 and the driver circuit unit 13 may be opposed to each other by a U-shaped folding of the film 21. The total mass of this display assembly is made thin and compact. The wiring pattern 22 is thus composed of conductive coating film.

FIG. 3 shows another preferred example of a liquid crystal display panel in plan view. In this example, a circuit substrate 27 such as a ceramic plate or the like is adhered to the film 21. One or more IC's 15 are disposed on the film 21 for providing column signals to the matrix type liquid crystal display 1. Connection terminals 28 between the circuit substrate 27 and wirings disposed on the film 21, the wirings being coupled to the IC's 15 as previously described, are provided which are bonded together by the above-mentioned thermal bonding with pressure. An insulating coating can be printed on the film 21. In case where another circuit substrate is connected to the circuit elements on the film 21 as, shown in FIG. 3, to print the insulating coating in addition to the above stated conductive coating makes their connection stronger and easier than to print only the conductive coating because of the cooperation by the conductive and the insulating coatings. As shown in FIG. 3, counter substrate 26 corresponding to the like-numbered element in FIG. 1 extends from the portion of film 21 which forms the first substrate of display 1. In forming the finished device, portion 26 is positioned opposite display area 1 of film 21, as shown in FIG. 1.

In this example, the conductive coating preferably includes a thermoplastic resin such as chloroprene-rubber and phenol resin, aluminum powder, and a binder made of toluene ethyl acetate.

A multi-layer wiring technique can be applied to the highly polymerized transparent film 21 to minimize the wiring pattern size within the purview of the invention.

In the foregoing embodiments, the highly polymerized compound film 21 is used for the front substrate of the liquid crystal display panel. Accordingly, there is a possibility that an interference color pattern is observed due to the cooperation of the sandwiching polarizers and the film. Of course, the interference is not observed in the dynamic scattering mode liquid crystal display, wherein the polarizers are not employed.

FIG. 4 shows a preferred arrangement to minimize the occurrence of interference color patterns. When the film substrate 21 is rounded between the polarizers 2 and 2', there are four directions 31 at which little interference is observed. If the direction 31 is parallel with the polarizing direction of the polarizers, the interference color pattern is never observed.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications are intended to be included within the scope of the invention as defined by the following claims.

What is claimed is:

1. A liquid crystal display cell comprising:
 - a flexible transparent highly polymerized compound film including a first section defining a first substrate for a liquid crystal display cell, and a second section extending from said first section;
 - first electrodes formed on said flexible transparent film in said first section, said first electrodes func-

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tioning as drive electrodes for said liquid crystal display cell;
wiring patterns formed on said flexible transparent film in said second section, said wiring patterns being electrically connected to said first electrodes;
a transparent counter substrate confronting said first section of said transparent film;
second electrodes formed on said transparent counter substrate, said second electrodes functioning as drive electrodes for said liquid crystal display cell in combination with said first electrodes;
liquid crystal compositions disposed between said flexible transparent film and said transparent counter substrate;
sealing means for sealing said liquid crystal compositions within said first section; and
at least one semiconductor circuit element mounted on said second section of said flexible transparent film and electrically connected to said wiring patterns;
wherein said first and second sections of said transparent film are positioned in different planes.

2. The liquid crystal display device of claim 1, wherein said planes are parallel to each other.

3. The liquid crystal display device of claim 2, wherein said wiring patterns are formed on and said at least one semiconductor element is positioned on a surface of said second section which faces said first section.

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4. A liquid crystal display cell comprising:
a flexible transparent highly polymerized compound film including a first section defining a first substrate for a liquid crystal display cell, and a second section extending from said first section;
first electrodes formed on said flexible transparent film in said first section, said first electrodes functioning as drive electrodes for said liquid crystal display cell;
wiring patterns formed on said flexible transparent film in said second section, said wiring patterns being electrically connected to said first electrodes;
a transparent counter substrate confronting said first section of said transparent film and comprising a portion of said flexible transparent film;
second electrodes formed on said transparent counter substrate, said second electrodes functioning as drive electrodes for said liquid crystal display cell in combination with said first electrodes;
liquid crystal compositions disposed between said flexible transparent film and said transparent counter substrate;
sealing means for sealing said liquid crystal compositions within said first section; and
at least one semiconductor circuit element mounted on said second section of said flexible transparent film and electrically connected to said wiring patterns.

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US005362547A

United States Patent [19]

Yamazaki

[11] Patent Number: 5,362,547

[45] Date of Patent: Nov. 8, 1994

[54] FILM CARRIER

[75] Inventor: Hideo Yamazaki, Sagamihara, Japan

[73] Assignee: Minnesota Mining and Manufacturing Company, St. Paul, Minn.

[21] Appl. No.: 745,918

[22] Filed: Aug. 16, 1991

[30] Foreign Application Priority Data

Aug. 20, 1990 [JP] Japan 2-86991[U]

[51] Int. Cl.⁵ B32B 3/28[52] U.S. Cl. 428/167; 428/156;
428/172; 428/209; 428/901[58] Field of Search 428/167, 156, 172, 188,
428/209, 901, 192; 174/250, 295

[56]

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Primary Examiner—Donald J. Loney

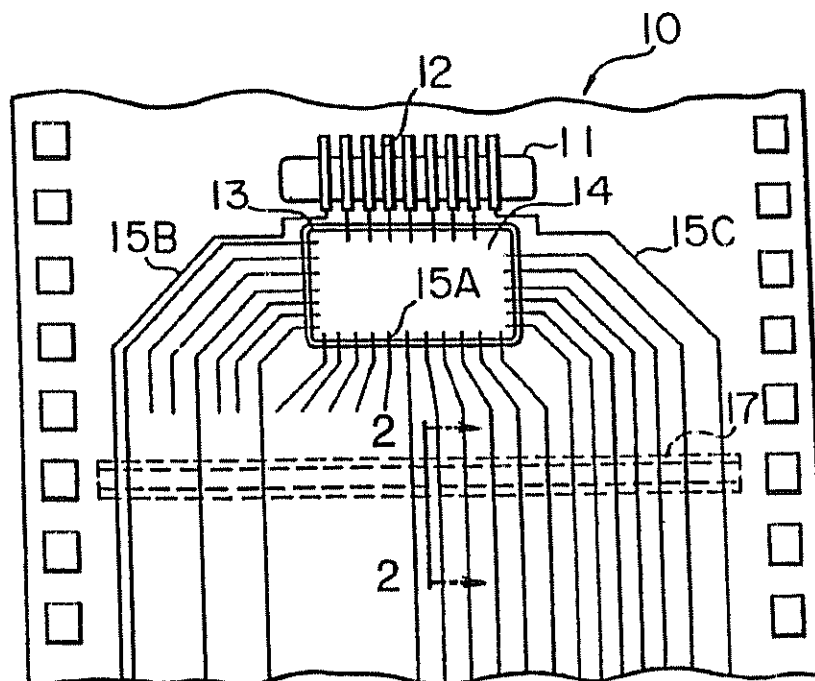
Attorney, Agent, or Firm—Gary L. Griswold; Walter N. Kirn; John C. Barnes

[57]

ABSTRACT

A film carrier having a multiplicity of leads bonded on one surface, is provided with a thickness-reduced portion at the area where the tape is to be bent to remove stress to the leads.

10 Claims, 3 Drawing Sheets



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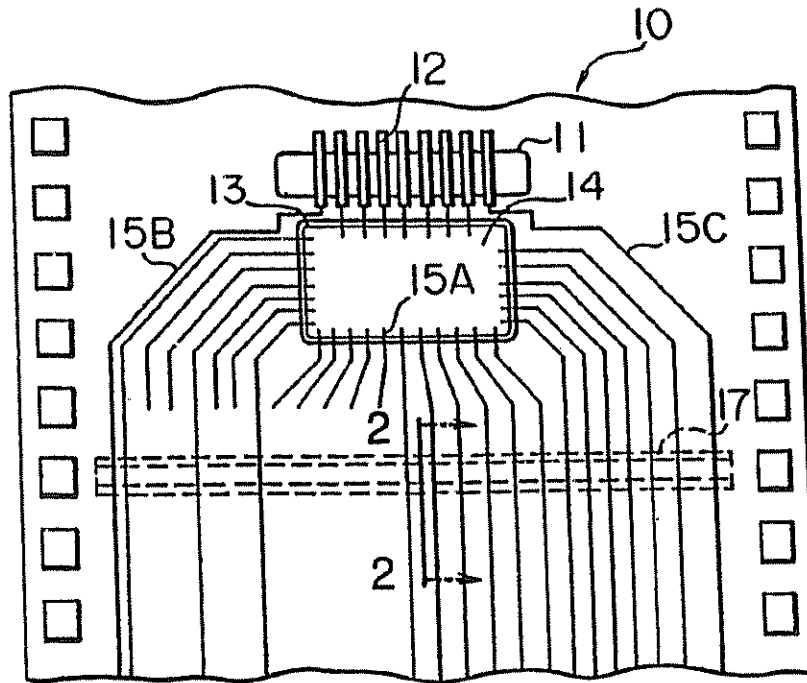


FIG. 1

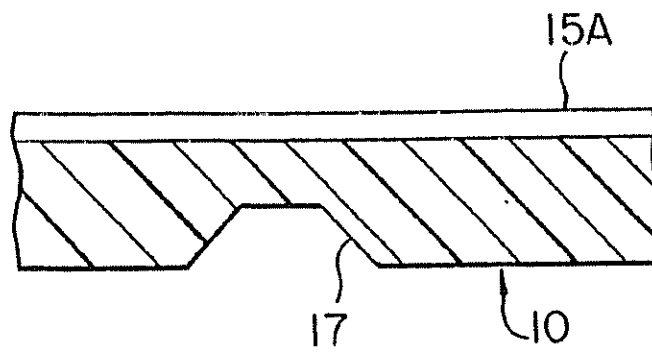


FIG. 2

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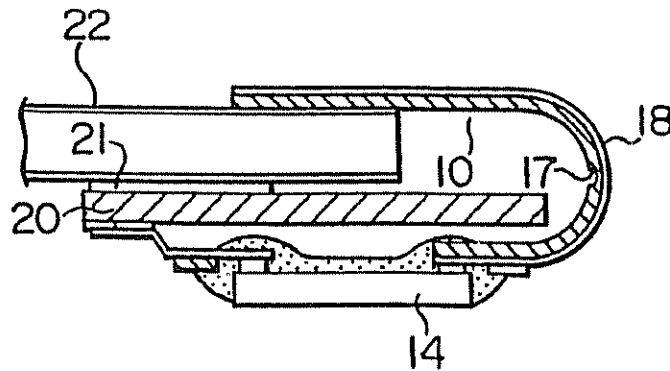


FIG. 3

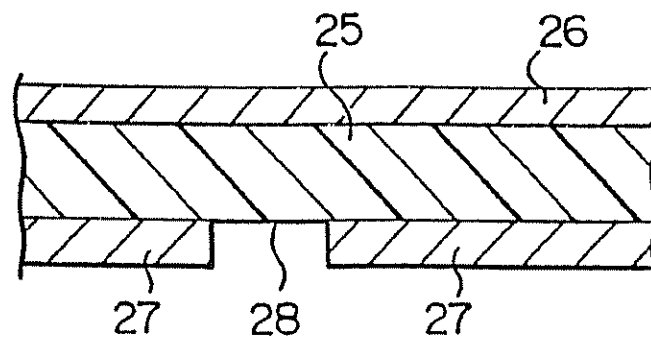


FIG. 4

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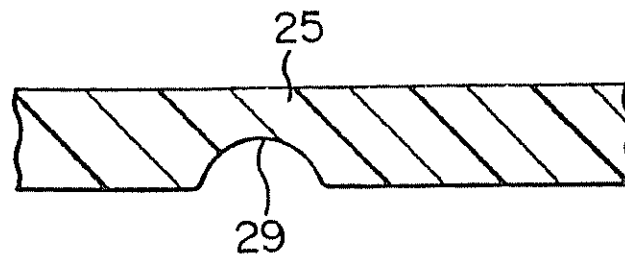


FIG. 5

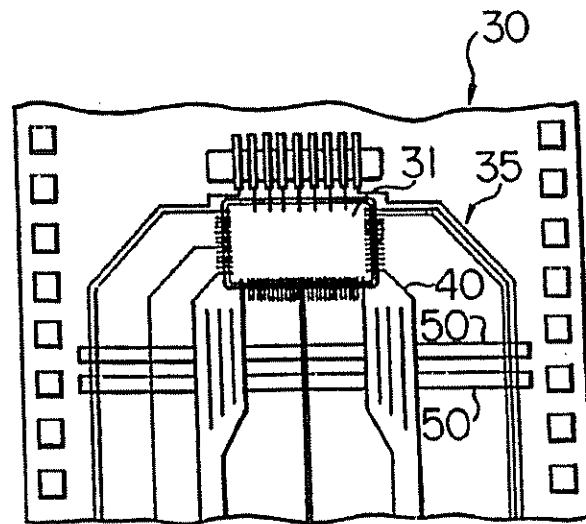


FIG. 6
Prior Art

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FILM CARRIER

FIELD OF THE INVENTION

The present invention relates to a film carrier on which an integrated circuit device or the like is mounted and wherein the film carrier is bent when a panel type display such as a liquid crystal display panel is manufactured.

BACKGROUND OF THE INVENTION

A conventional film carrier (see Japanese Patent Laid-Open No. 1-251079) has been arranged as shown in FIG. 6 in such a manner that reinforcing leads 35 and 40 are provided on a film carrier 30 and two slits 50 are formed at a bent portion.

The conventional film carrier has no organic insulating film for supporting the leads, which serve as conductor patterns, in the above-described slit portion. Therefore, the conductor pattern may be easily deformed, causing an electric short circuit to occur at the time of the bending work or other working processes. Furthermore, the conductor pattern in the slit appears outside when viewed from the organic insulating film side. Therefore, the lead may encounter an electric short circuit with the adjacent leads and the peripheral circuits.

The present invention provides a film carrier capable of overcoming the above-described problems and assuredly preventing the electric short circuit which takes place in a conductor pattern formed on the film carrier.

SUMMARY OF THE INVENTION

The above-described problems are overcome by the present invention in a film carrier made of an organic insulating film arranged to have a thickness-reduced portion extending transversely to the lengthwise direction of a multiplicity of leads secured to the film in such a manner that the multiplicity of leads are separated from and run parallel to one another, the thickness-reduced portion being formed for the purpose of aiding to bend the film.

It is preferable that the thickness-reduced portion be in the form of a groove on the side of the film opposite the leads.

The film carrier constituted as described above can be easily bent together with the leads due to the provision of the thickness-reduced portion extending perpendicularly to the lengthwise direction of a multiplicity of the leads.

Furthermore, the leads disposed on the surface of the film and the mounted body are physically disposed outside.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view which illustrates an embodiment of the present invention;

FIG. 2 is a cross sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a vertical cross section of the embodiment shown in FIG. 1;

FIG. 4 is a vertical cross sectional view which illustrates the method of manufacturing another embodiment of the present invention;

FIG. 5 is a vertical cross sectional view which illustrates another embodiment of the present invention; and

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FIG. 6 is a plan view which illustrates a conventional film carrier.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Two embodiments of a film carrier according to the present invention will be described with reference to the drawings.

FIG. 1 illustrates a portion of a first embodiment of a film carrier 10 made of an organic insulating film.

A semiconductor device 14 disposed in a device opening 13 is mounted on the film carrier 10. A multiplicity of leads 15A, 15B and 15C each of which is made of copper are, then bonded to the leads of the device, which leads extend from the semiconductor device 14 in the lengthwise direction of the film carrier.

The film carrier 10 is bent (see FIG. 3) when it is used in such a manner that a portion 18 thereof is bent substantially semicircularly. As a result, a compact semiconductor device, such as a panel type display including a crystal display panel or the like, can be manufactured.

The film carrier according to this embodiment has a groove 17 (see FIG. 2) on the reverse side thereof in a direction transverse, and as indicated in the drawing perpendicular, to the lengthwise direction of the above-described multiplicity of leads 15A. Although a single groove is provided according to this embodiment, a plurality of grooves may be formed.

FIG. 2 is a cross sectional view of the film 10 shown in FIG. 1 taken along line 2—2 of FIG. 1, where a plurality of the leads, 15A, 15B, 15C are disposed on the film 10 and the groove 17 formed in the film 10 has a trapezoidal cross sectional shape. FIG. 5 shows the groove 29 according to another embodiment of the present invention, the groove having a substantially semicircular cross sectional shape. According to the above-described examples, the structure is arranged in such a manner that the concentration of residual stress to a portion after the bending can be prevented.

A case in which the film carrier according to the present invention is bent in the form of a substantially semicircular shape will be described with reference to an embodiment shown in FIG. 3.

The film carrier 10 is bent at the bending portion 18 thereof. The semiconductor device 14 is mounted on the film carrier 10 and a printed circuit substrate 20 and a liquid crystal display panel 22 are, by an adhesive 21, disposed on the inner surface of the thus bent film carrier. Since the bent film carrier 10 has no slit which has been provided for the conventional type film carrier, an extremely strong durability is exhibited.

The angle and the bending direction may be properly determined in accordance with the state of mounting, that is, they may be properly determined in consideration of the direction of the extension of the leads along the surface of the film carrier.

Then, a method of manufacturing the groove according to another embodiment (see FIG. 5) will be described with reference to FIG. 4.

In a first process, photosensitive films 26 and 27, which are stable to chemicals which are used for dissolving the organic insulating film, are respectively applied to the upper and the lower surfaces of the film carrier 25. In a second process, a portion of the photosensitive film 27 is removed by a photolithography. As a third process, the organic insulating film in the portion 28, from which the photosensitive film has been removed in the second process, is dissolved by chemical

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etching so as to reduce the thickness of the subject portion. Reference numeral 29 shown in FIG. 5 represents the cross sectional shape of the thickness-reduced portion. In a fourth process, the photosensitive films 26 and 27 applied in the first process are removed.

As another embodiment, the groove in the film carrier according to the present invention may be formed by laser beams.

Since the film carrier, according to the present invention, is constituted as described above, it can be easily manufactured. Furthermore, the electric short circuit which takes place in a conductor pattern formed on the film carrier according to the present invention can be assuredly prevented, that is, the electric short circuit which takes place between the leads and between the peripheral conductor pattern and the circuit can be assuredly prevented.

I claim:

1. A film carrier for supporting an integrated circuit device and comprising an organic electrically insulating film arranged to have a thickness-reduced portion extending perpendicularly to the lengthwise direction of a multiplicity of copper leads secured to said film in such a manner that said multiplicity of leads are separated from and run parallel to one another, said thickness-reduced portion being formed for the purpose of aiding to bend said film;

2. A film carrier according to claim 1 wherein said thickness-reduced portion is a groove which is trapezoidal in cross-section.

3. A film carrier according to claim 1, wherein said thickness-reduced portion is in the form of a groove on the side of said film opposite the side to which said leads are secured.

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4. A film carrier according to claim 3 wherein said groove is semicircular in cross-section.

5. A film carrier for use in connecting electronic devices comprising a sheet of electrically insulating film having opposite surfaces and having a multiplicity of electrical leads adhered to one surface of the film and separated from and extending generally parallel to each other along said surface, said sheet having a thickness-reduced portion formed in the surface opposite said one surface supporting said leads and extending transverse to said leads to aid in bending the sheet and the leads.

6. A film carrier according to claim 5 wherein said thickness-reduced portion is a groove formed in the surface of the sheet and having a depth to leave film supporting the leads on said one surface.

7. A film carrier according to claim 6 wherein said groove is semicircular in cross-section.

8. A film carrier according to claim 6 wherein said groove is trapezoidal in cross-section.

9. A film carrier for use in connecting electronic devices comprising a sheet of electrically insulating film having opposite surfaces and having a multiplicity of electrical leads adhered to one surface of the film and separated from and extending generally parallel to each other along said surface, said sheet having a thickness-reduced portion formed in the surface opposite said one surface supporting said leads and extending transverse to said leads to aid in bending the sheet and the leads, wherein the thickness-reduced portion is perpendicular to the path of the leads.

10. A film carrier according to claim 9 wherein an integrated circuit device is mounted on the film and bonded to said leads.

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US005398128A

United States Patent [19][11] **Patent Number:** **5,398,128****Tajima et al.**[45] **Date of Patent:** **Mar. 14, 1995**

[54] **WIRING BOARD FOR USE IN A LIQUID CRYSTAL PANEL AND METHOD OF MAKING INCLUDING FORMING RESIN OVER SLIT BEFORE BENDING**

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Primary Examiner—Anita Pellman Gross
Attorney, Agent, or Firm—Nixon & Vanderhye

[75] **Inventors:** Naoyuki Tajima, Kita-Katsuragi; Takaaki Tsuda, Tenri, both of Japan

[73] **Assignee:** Sharp Kabushiki Kaisha, Osaka, Japan

[21] **Appl. No.:** 868,561

[22] **Filed:** Apr. 15, 1992

[30] **Foreign Application Priority Data**

May 21, 1991 [JP] Japan 3-035603 U

[51] **Int. Cl.⁶** G02F 1/1333; G02F 1/1335

[52] **U.S. Cl.** 359/82; 359/62

[58] **Field of Search** 359/62, 82, 88; 156/901, 902

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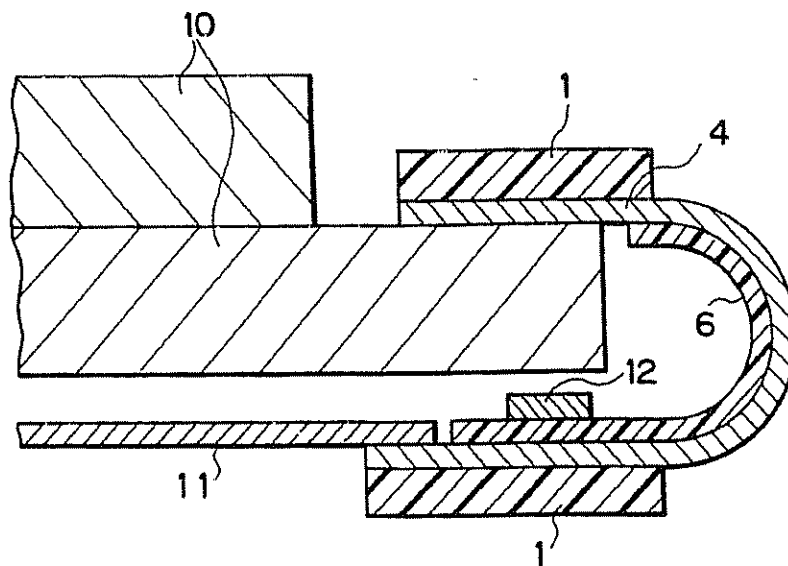
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[57] **ABSTRACT**

A board for installation in a liquid crystal panel with at least one slit at a portion thereof to be bent has a resin coating applied to a bridge portion of a conductive pattern formed over the slit. The resin coating resists external load applied during bending of the board. This board may be made by a method having the steps of punching a slit in the board corresponding to a position where the board is to be bent; forming a metal laminate on the board; forming a conductive pattern by etching the metal laminate; applying a resin coating capable of resisting an external load, which is applied during subsequent bending of the board, onto the conductive pattern across the slit; and curing the resin coating. The board is thereafter bent and installed in a liquid crystal panel.

16 Claims, 6 Drawing Sheets



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Fig. 1a

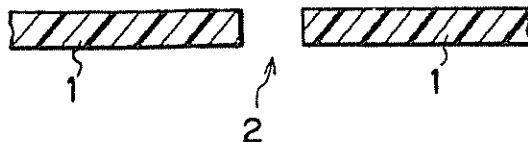


Fig. 1b

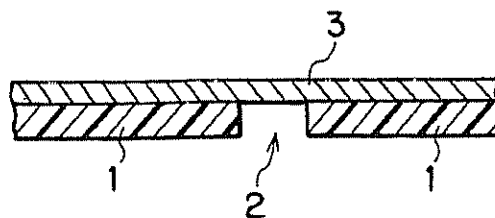


Fig. 1c

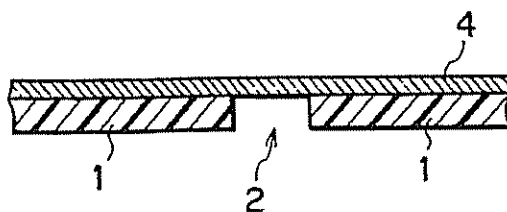
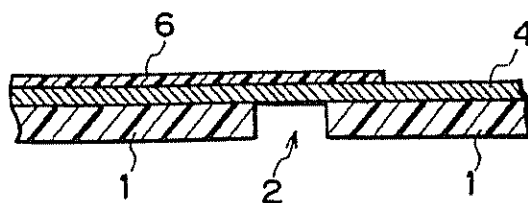


Fig. 1d



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Fig. 2

